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LAKE ONTARIO BASIN

BURT DAM

NIAGARA COUNTY, NEW YORK
INVENTORY No. N.Y. 745

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NEW YORK DISTRICT, CORPS OF ENGINEERS

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Burt Dam
Niagara County
Lake Ontario Basin

ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Examination of available documents and a visual inspection of the dam did not reveal conditions which constitute an immediate hazard to human life and property. However, the dam has some deficiencies which require further investigation and remedial action.

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The hydrologic/hydraulic analysis performed indicates that the spillway does not have sufficient capacity to discharge the peak outflow from one-half the Probable Maximum Flood (PMF). However, spillway discharges occurring during large storm events will cause water surface elevations in the downstream hazard area to rise to flood levels. A dam failure resulting from overtopping would not significantly increase the hazard to loss of life from that which would exist just prior to an overtopping failure. Therefore, the spillway is assessed as inadequate.

Since the structural stability analysis performed by the dam's designer could not be located, an analysis was performed as part of this Phase I Investigation. It indicated that the sliding and overturning factors of safety, for normal operating conditions, are less than the recommended minimum values. In addition, the dam is located in Seismic Zone 3, and there is no record of a suitable seismic analysis being performed. Therefore, an additional investigation by a qualified registered professional engineer to evaluate the normal and seismic stability of the dam is recommended.

The investigation should be completed within 12 months of notification to the owner, and remedial actions resulting from the investigation completed in the subsequent 12 months.

The following remedial measures should be performed within 1 year of notification to owner:

- Replace the missing floor grating on the bridge across the spillway.

- Paint the bridge across the spillway.

- Install hand rails the full length of the dam crest.

- Repair the gate hoist controlling the reservoir drain gate.

- Install fencing at the east abutment and post warning signs at both abutments to discourage treaspassers.

- Clean debris and vegetation from areas atop the downstream face of dam and from both abutments.

- Implement a program of diligent and periodic maintenance including but not limited to: operation and lubrication of the reservoir drain, patching spalled and eroded concrete areas, and clearing debris and trash from trash racks, and from upstream slopes.

- Develop a formal written downstream warning system to alert the appropriate officials and residents in the event of an emergency.

- Develop and maintain a program of biannual technical inspections.

LAKE ONTARIO BASIN

BURT DAM

NIAGARA COUNTY, NEW YORK
INVENTORY No. N.Y. 745

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM.

Burt Dam (Inventory Number NY. 745),
Lake Ontario Basin, Niagara County,
New York. Phase 1 Inspection Report,

Robert J. Farrell

15) DACW51-81-C-0017

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NEW YORK DISTRICT, CORPS OF ENGINEERS

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines
for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines
may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314.
The purpose of a Phase I Investigation is to identify expeditiously those dams
which may pose hazards to human life or property. The assessment of the general
condition of the dam is based upon available data and visual inspections. Detailed
investigation and analyses involving topographic mapping, subsurface investigations,
testing, and detailed computational evaluations are beyond the scope of a Phase
I Investigation; however, the Investigation is intended to identify any need for
such studies.

In reviewing this report, it should be realized that the reported condition of
the dam is based on observations of field conditions at the time of inspection
along with data available to the inspection team. In cases where the reservoir
was lowered or drained prior to inspection, such action, while improving the
stability and safety of the dam, removes the normal load on the structure and
may obscure certain conditions which might otherwise be detectable if inspected
under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and
constantly changing internal and external conditions, and is evolutionary in
nature. It would be incorrect to assume that the present condition of the dam
will continue to represent the condition of the dam at some point in the future.
Only through frequent inspections can unsafe conditions be detected and only
through continued care and maintenance can these conditions be prevented
or corrected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic
analyses. In accordance with the established Guidelines, the Spillway Test Flood
is based on the estimated "Probable Maximum Flood" for the region (greatest
reasonably possible storm runoff), or fractions thereof. Because of the magnitude
and rarity of such a storm event a finding that a spillway will not pass the Test
Flood should not be interpreted as necessarily posing a highly inadequate condition.
The Test Flood provides a measure of relative spillway capacity and serves
as an aid in determining the need for more detailed hydrologic and hydraulic
studies, considering the size of the dam, its general condition and the downstream
damage potential.

TABLE OF CONTENTS

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam: Burt Dam

State Located: New York

County Located: Niagara

Stream: Eighteenmile Creek

Basin: Lake Ontario

Date of Inspection: May 19, 1981

ASSESSMENT

Examination of available documents and a visual inspection of the dam did not reveal conditions which constitute an immediate hazard to human life and property. However, the dam has some deficiencies which require further investigation and remedial action.

The hydrologic/hydraulic analysis performed indicates that the spillway does not have sufficient capacity to discharge the peak outflow from one-half the Probable Maximum Flood (PMF). However, spillway discharges occurring during large storm events will cause water surface elevations in the downstream hazard area to rise to flood levels. A dam failure resulting from overtopping would not significantly increase the hazard to loss of life from that which would exist just prior to an overtopping failure. Therefore, the spillway is assessed as inadequate.

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- Clean debris and vegetation from areas atop the downstream face of dam and from both abutments.

- Implement a program of diligent and periodic maintenance including but not limited to: operation and lubrication of the reservoir drain, patching spalled and eroded concrete areas, and clearing debris and trash from trash racks, and from upstream slopes.

- Develop a formal written downstream warning system to alert the appropriate officials and residents in the event of an emergency.

- Develop and maintain a program of biannual technical inspections.

Robert J. Farrell, P.E.
New York No. 55983

Col. W.M. Smith, Jr.
New York District Engineer

Approved by:

Date: 27 Aug 81

Burt Dam
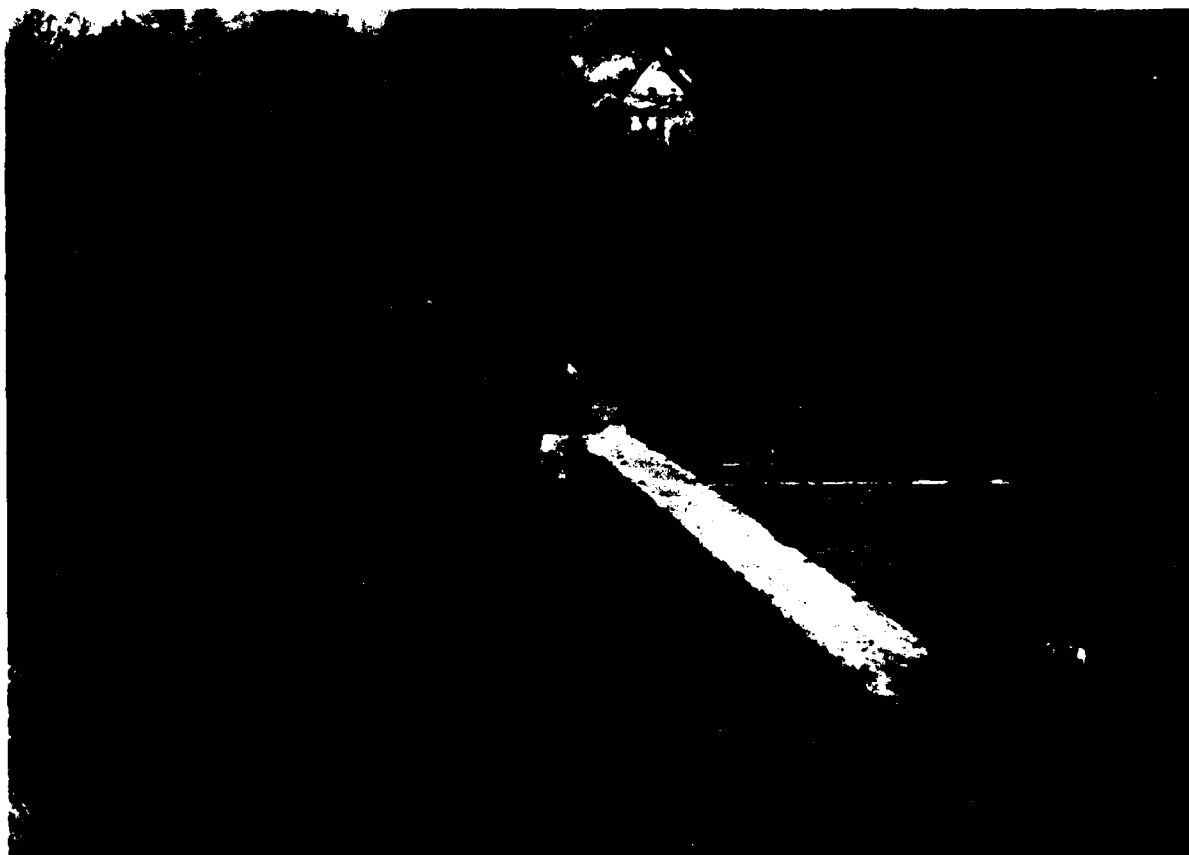
OVERVIEW
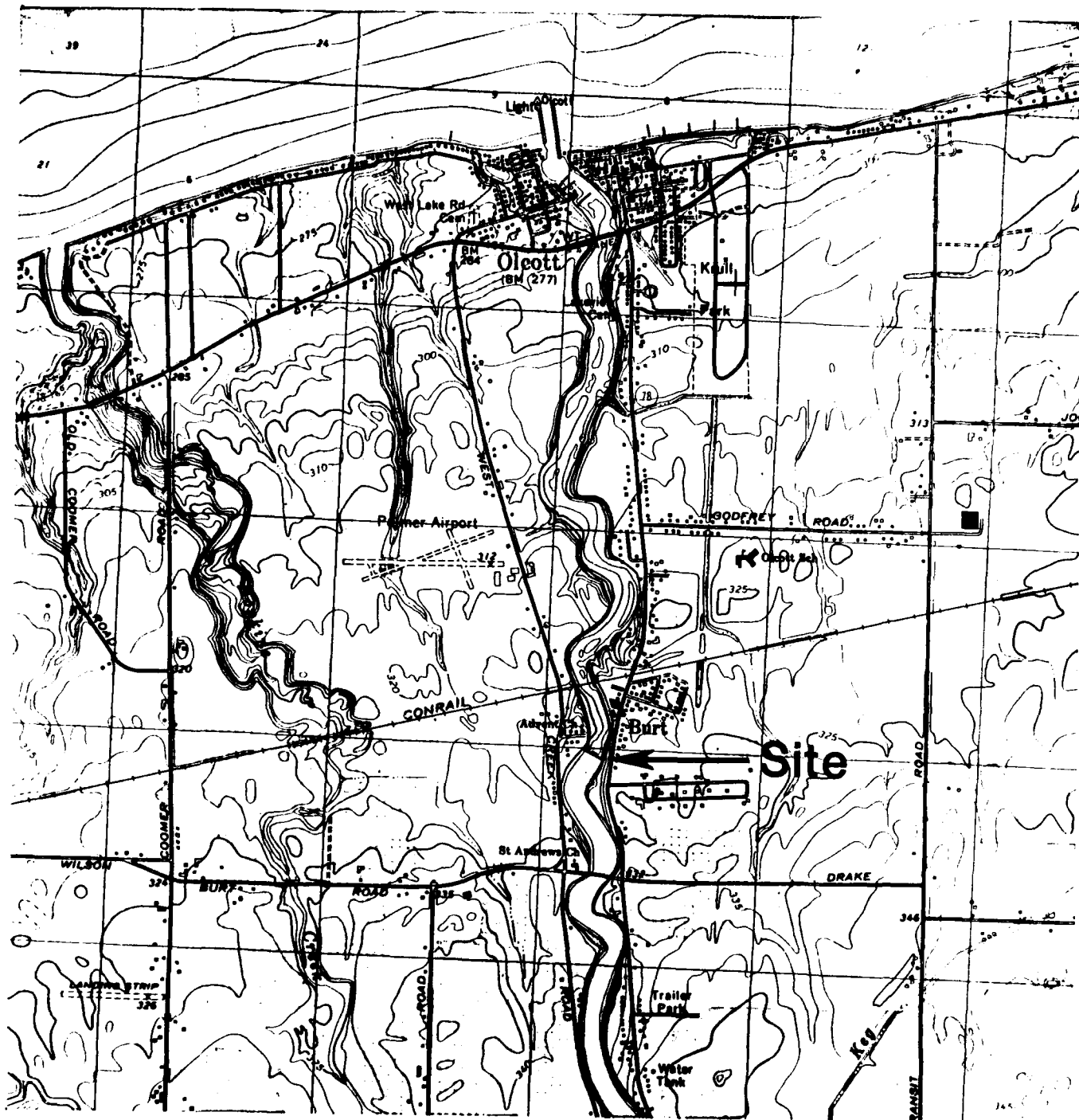
Burt Dam

LOCATION PLAN

Scale: 1" = 2000'

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BURT DAM
I.D. NO. NY 745
D.E.C. NO.15C-272
LAKE ONTARIO BASIN
NIAGARA COUNTY, NEW YORK

SECTION I - PROJECT INFORMATION

1.1   GENERAL

a.   Authority

The Phase I inspection reported herein was authorized by
the Department of the Army, New York District, Corps of Engineers,
to fulfill the requirements of the National Dam Inspection Act, Public
Law 92-367, dated 8 August 1972.

b.   Purpose of Inspection

This inspection was conduted to evaluate the existing conditions
of the dam, to identify deficiencies and hazardous conditions, to determine
if these deficiencies constitute hazards to life and property, and to recommend
remedial measures where required.

1.2   DESCRIPTION OF THE PROJECT

a.   Description of Dam and Appurtenances

Burt Dam is an unreinforced concrete gravity dam with an ogee
spillway located near the west abutment. It is approximately 328 ft. long
and has a maximum height of 54.5 ft. The crest width of the dam is 5 ft.
The upstream face of the dam is vertical. The downstream face is vertical
for the top 7.5 ft. below which the face slopes at approximately 1 ft.
vertical to .77 ft. horizontal.

The principal ogee spillway is 75 ft. wide and 7.5 ft. deep. The reservoir
drain consists of a 6 ft. conduit running through the east end of the spillway
section. It is operated by a vertical lift sluice gate with a gate hoist positioned
on the walkway above the spillway.

The dam contains three penstocks. According to the design calculations
two measure 9 ft. by 14 ft. while the third is 11 ft. by 18 ft. The penstocks,
located near the center of the dam, at one time carried flow to the turbines
in the powerhouse on the downstream face of the dam. The flow into the
penstocks was controlled by two vertical lift sluice gates per penstock.

b. Location

The dam is located on Eighteenmile Creek approximately 0.2 miles south of Burt, New York. The dam is approximately 1.5 miles south of the intersection of N.Y.S. Route 18 and 78.

c. Size Classification

The dam is 54.5 ft. high and the reservoir has a storage capacity of 2447 acre-ft. The dam is classified as "INTERMEDIATE" in size (40 to 100 ft. in height).

d. Hazard Classification

The hazard classification for this dam is HIGH because of the potential for loss of life and property 2.0 miles downstream in the event of dam failure.

e. Ownership

Burt Dam is owned by the Olcott Harbor Board of Trade, a local association of businessmen. No address or telephone is listed for this organization. An application for converting the dam to power generation is pending with the Federal Energy Regulatory Commission by:

    J. W. Company
    Jeffery Moon, President
    55 Union Place
    Manchester, Connecticut 06040
    Tele: (207) 775-5401

f. Purpose of Dam

Burt Dam was originally constructed for hydroelectric power generation. It presently serves no useful purpose.

g. Design and Construction History

The dam was designed and constructed by McCarthy Brothers and Ford of Buffalo, New York in 1924. The original owner was Lockport and Newfane Power and Water Supply Co.; it was later sold to Niagara Mohawk Power Co. "As-built" dam drawings were obtained from the New York State Department of Environmental Conservation, Albany, New York.

h. Normal Operating Procedure

No regular procedure of operating the sluice gates at the dam presently exists. Normal flows pass over the ogee spillway.

1.3 PERTINENT DATA

a.	**Drainage Area**		77.4 sq. miles
b.	**Discharge at Damsite**		
	Maximum known flood at Damsite		Unknown
	Recent maximum discharge (from high water mark)		1867 cfs
	Principal Spillway		
		Maximum Pool	6116 cfs
	Total Spillway Capacity at Maximum		
		Pool Elevation	6116 cfs
c.	**Elevation** (U.S.G.S. Datum)		
	Top of Dam		304.5 ft.
	Maximum Pool		304.5 ft.
	Normal Pool		297.0 ft.
	Principal Spillway Crest		297.0 ft.
d.	**Reservoir**		
	Length of Normal Pool		1050 ft.
	Length of Maximum Pool		1300 ft.
e.	**Storage**		
	Normal Pool		1488 acre-ft.
	Maximum Pool		2447 acre-ft.
f.	**Reservoir Surface**		
	Normal Pool		95 acres
	Maximum Pool		149 acres
g.	**Dam**		
	Type		Concrete Gravity
	Length		328$^{\pm}$ ft.
	Maximum Height		54.5$^{\pm}$ ft.
	Top Width		5 ft.
	Side Slopes (V:H)		
		Upstream	Vertical
		Downstream	Vertical to 1V:0.77H
h.	**Reservoir Drain**		
	Type		Conduit
	Dimensions		6 ft. x 6 ft.
	Closure		Vertical lift sluice gate
	Invert Elevation		252 ft.
i.	**Principal Spillway**		
	Type		Concrete Ogee
	Base Width		75 ft.
	Height		7.5 ft.
	Side Slopes		Vertical
	Location		Near west abutment

SECTION 2 - ENGINEERING DATA

2.1 GEOLOGY

The stratigraphy in northern Niagara County consists of relatively undeformed flat-lying sedimentary rocks of upper Ordovician age (450-425 million years ago). The bedrock formation is red bedded, massive shales with some interbedded silt-stones and silty dolomites of the Queenston Shale Formation. The shale rock is generally moderately soft, and tends to break down rapidly upon exposure. The siltstones and silty dolomites are generally moderately hard and tend to resist weathering. The rock forms a homocline which dips southward to southwestward at approximately 40 feet per mile. Only minor folding and faulting are found in the region with no major or active faults known to exist in the area.

The Village of Olcott and the Burt Dam are in a region classified as Zone 3 seismicity, as shown on Figure No. 1 of the Recommended Guidelines for Safety Inspection of Dams.

Glaciations of the area was extensive. During the glacial period (Pleistocene Eopch), spanning about 1.5 million years, the area was over-ridden many times by a thick continental ice sheet moving southward over the region, from Quebec and Ontario, eroding the rock and changing drainage patterns. Soil deposits left by the glacier include lake silt, sand and clayey silts deposited as off-shore deposits of primitive lakes of the Lake Iroquois stage in the Ontario basin.

2.2 SUBSURFACE INVESTIGATION

No subsurface investigations could be located for the dam.

2.3 DESIGN RECORDS

The records available for the project consist of 4 contract drawings which show plans, sections and details of the dam and powerhouse, the original "application for Construction of a Dam", and several sheets of correspondence, some of which discuss the selected design discharge.

2.4 CONSTRUCTION RECORDS

The only construction records available consist of correspondence between the dam's designer and various public agencies.

2.5 OPERATION RECORD

An effort to locate the operation record was unsuccessful.

2.6 EVALUATION OF DATA

The information presented was obtained primarily from NYSDEC files and appears adequate and reliable for Phase I inspection and evaluation.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

A visual inspection of Burt Dam was made on May 19, 1981. The weather was sunny, and the temperature was in the mid-seventies. The reservoir level at the time of the inspection was at elevation 297.5 MSL, 6 in. above the spillway crest.

b. Foundation

Foundation rock is generally competent and lightly weathered from the left abutment downstream. There is a horizontal clay seam (1/4 in. to 1/2 in. thick) approximately 6 ft. above the tailwater surface. Water exits this seam as a minor weep of approximately 2 GPM for its entire length. Scree covers the slope at the right abutment. Downstream of the dam (150 ft. to 200 ft.) is an outcrop of red, thin to medium bedded shale, which is moderately weathered. Slaking shale has been deposited downslope.

c. Dam

The dam is generally in good condition. However, several deficiencies and areas of deterioration were noted. These include:

1. Significant areas of eroded and spalled concrete were observed along the entire crest of the dam, as well as along both spillway sidewalls. In addition, cracks, significant spalls and effervescent stains were observed on the downstream face of the dam; although it was completely dry at the time of the inspection.

2. The gate hoist controlling the reservoir drain sluice gate is inoperative. The electric motor has been removed, and the electrical wiring has been disconnected and abandonded.

3. The wood stairs at the east abutment are seriously deteriorated.

4. Water seepage was observed along the west side of the west spillway sidewall.

5. Trees and vegetation were observed at both abutments and atop the downstream face of the dam.

3.2 EVALUATION OF OBSERVATIONS

Visual observations made during the course of the inspection did not indicate any serious problems which would adversely affect the adequacy of the dam. The following is a summary of the problem areas encountered, in order of importance, with the appropriate recommended action:

1. The missing floor grating on the bridge across the spillway should be replaced. The entire bridge should be painted.

2. Handrails should be installed the full length of the dam crest.

3. The stairs at the east abutment should be repaired or replaced.

4. The gate hoist controlling the reservoir drain sluice gate should be made operational. The gate should be exercised and lubricated annually.

5. The reservoir should be lowered below the spillway crest so that the spillway and downstream toe of the dam can be inspected.

6. Fencing should be installed at the east abutment and warning signs posted at both abutments to discourage trespassers.

7. The concrete cracks and spalls should be monitored.

8. Some debris has collected near the crest of the principal spillway. This debris should be removed on an annual basis.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

No written operation and maintenance procedures exist for the project. The normal operation of the project consists of allowing water to flow over the spillway section of the dam. It appears that the reservoir drain has not been used in many years.

4.2 MAINTENANCE OF DAM

The dam's owner, the Olcott Harbor Board of Trade, practices a policy of deferred maintenance.

4.3 WARNING SYSTEM IN EFFECT

No warning system is in effect or in preparation.

4.4 EVALUATION

The dam and appurtenances have not been maintained in satisfactory condition as noted in "Section 3: Visual Inspection".

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

Burt Dam is located on Eighteenmile Creek in the Lake Ontario basin, and has a drainage area of 77.4 square miles. The dam is situated approximately 1200 ft. south of Burt, New York in the Town of Newfane. The topography of the watershed is gently northward sloping farmlands, with orchards and woodland.

5.2 DESIGN DATA

Burt Dam was constructed for the purpose of hydroelectric power generation, although power is not currently being generated. According to the application for construction of the dam, dated April 24, 1924, the design flow for the dam was 5,940 cfs (144 cfs/acre). This figure was computed by assuming a peak flow of 64 cfs/sq. mi. over an 85 square mile drainage basin plus 500 cfs overflow from the New York State Barge Canal. The combined discharges from the spillway, penstocks, and sluice gate of 5953 cfs produces a design high water of 302.0 ft. (MSL). The ogee spillway control cross section is 75 ft. wide with a crest elevation of 297.0 ft. (MSL). The dam crest elevation is 304.5 ft. (MSL).

5.3 ANALYSIS CRITERIA

The analysis of the spillway capacity of the dam and the storage of the reservoir was performed using the Corps of Engineers HEC-1 Dam Safety Version computer model. The unit hydrograph was defined by the Snyder Synthetic Unit Hydrograph method. The drainage area for Burt Dam was divided into three smaller drainage areas: Eighteenmile Creek, East Branch Eighteenmile Creek, and the West Branch Eighteenmile Creek; and routed downstream by means of the Muskingam routing procedure. The three penstocks and the reservoir drain gate are inoperable and were excluded as factors in the hydraulic analysis as were the tailwater effects of Lake Ontario. The Probable Maximum Precipitation (PMP) was 21.8 in. (24 hours 200 sq. miles) from Hydrometerological Report #33 in accordance with the Recommended Guidelines of the Corps of Engineers. The dam is 54.5 ft. high and impounds approximately 2447 acre-ft. at the top of the dam. The dam is classified as a HIGH hazard and INTERMEDIATE in size, according to the Recommended Guidelines of the Corps of Engineers. The spillway design flood is the Probable Maximum Flood (PMF). The floods selected for analysis were 20, 40, 50, 60, 80 and 100% of the PMF flows. The PMF inflow of 65,495 cfs was routed through the reservoir and the peak outflow was determined to be 65,687 cfs. The peak PMF elevation is 316.8 ft. (MSL) or 12.3 ft. above the top of dam. The maximum elevation for one half the PMF is 311.7 ft. (MSL) or 7.2 ft. above the top of the dam. The inflow and outflow for one half the PMF are 32,748 cfs and 32,785 cfs, respectively.

5.4 RESERVOIR CAPACITY

The reservoir capacities at the crest of the spillway and at the top of the dam are 1488 acre-ft. and 2447 acre-ft., respectively. Surcharge storage between the spillway crest and the top of the dam is equivalent to 0.23 in. of runoff from the drainage area.

5.5 EXPERIENCE DATA

There are no flood records for the dam site. However, during the field investigation evidence of recent high water was observed at elevation 300.4 ft. (MSL). This reservoir elevation corresponds to a peak outflow of 1867 cfs.

5.6 OVERTOPPING POTENTIAL

The maximum capacity of the spillway is 6116 cfs which is less than the PMF peak outflow of 65,687 cfs. The dam is overtopped by the PMF, the peak elevation being 12.3 ft. above the top of the dam. The dam is also overtopped by half the PMF, the peak elevation being 7.2 ft. above the top of the dam. The dam will be overtopped by floods greater than 10% of the PMF.

5.7 ANALYSIS OF DOWNSTREAM IMPACTS

During the field investigation, dwellings and highways located downstream of the dam were identified and referenced to the channel invert. The cross section locations used in the downstream channel routing are shown on Page D-2, Appendix D. The impacts of the PMF on dwellings located downstream of the dam are shown in Table 5.1. For the purposes of this analysis, a danger of loss of life was assumed to exist if the computed PMF water surface was above the first floor elevation of a structure. This situation occurs at a substantial number of structures (Locations 7 & 8) as well as some small roads being overtopped at Location 8. The potential danger of loss of life and economic damage is substantial enough to warrant classification as a HIGH hazard dam.

5.8 EVALUATION

The spillway of Burt Dam will safely pass only 10% of the PMF without overtopping. The spillway, therefore, is assessed as inadequate.

ETL 1110-2-234, Section 5, gives the basis for determining whether or not a spillway should be classified as seriously inadequate. The results of this investigation indicates that there would not be a significant increase in the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. This is illustrated by the elevation - discharge relationship shown in Figure 5.1. The increase in flow above elevation 304.5 ft. (MSL) does not appear to be significant, therefore the spillway is assessed as inadequate. Potential problems include:

a) The danger of loss of life and economic damage in the harbor area (Locations 7 & 8) downstream of the dam for floods in the 1/2 PMF to PMF range.

TABLE 5.1

SUMMARY OF DOWNSTREAM IMPACTS FOR PMF

Location # (See pg. D-2, Appendix D)	Location	# of Dwellings	Structure Height Above (1) Streambed (ft)	Peak Flow (cfs)	Peak Stage (2) (ft)	Comments
-	At Dam	-	-	65,687	-	-
1	500' d/s of dam	-	-	65,662	34.7	-
2	800' d/s of Loc. 1	-	-	65,647	36.5	-
3	1300' d/s of Loc. 2	-	-	65,609	19.2	-
4	1100' d/s of Loc. 3	-	-	65,605	18.6	-
5	1800' d/s of Loc. 4	-	-	65,582	16.6	-
6	1700' d/s of Loc. 5	-	-	65,604	17.7	-
7	1600' d/s of Loc. 6	1 boathouse	11.5	65,612	16.4	Danger of loss of life
	500' d/s of Loc. 7	1 boathouse	13.0	65,612	15.2	
	"	1 house	17.6	65,612	15.2	
	"	1 house	14.3	65,612	15.2	
	"	1 house	15.7	65,612	15.2	
8	1400' d/s of Loc. 7	50 houses	13.4	65,622	14.0	Danger of loss of life
		1 yacht club	14.4	65,622	14.0	Roads on the west side @ Loc 8 will be overtopped.
		1 boat co.	14.9	65,622	14.0	
		1 commercial	15.1	65,622	14.0	

Notes: (1) Structure height above streambed is the difference in elevation of dwelling's 1st floor & channel invert.
(2) Tailwater effects of Lake Ontario were not considered in the analysis

DISCHARGE IN CFS x 1000

ELEVATION IN FEET (MSL)

OGEE SPILLWAY

TOTAL

TOP OF DAM = 304.5

SPILLWAY CREST = 297.0
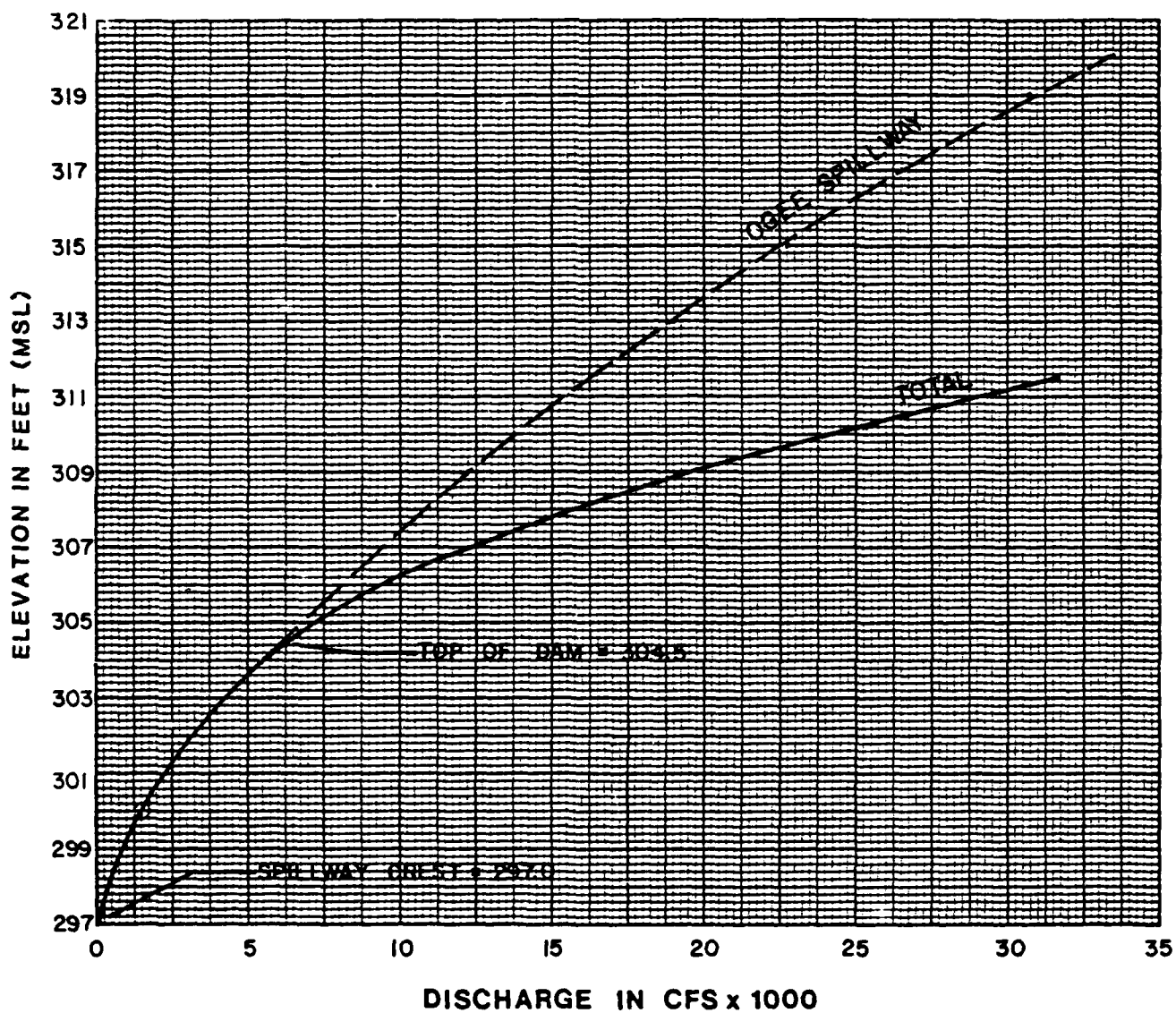
BURT DAM (N.Y. 745)	
RATING CURVE	
PHASE I DAM INSPECTION REPORT	
DATE: JULY, 1981	FIGURE 5.1

SECTION 6 - STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS

Visual observations did not detect any settlement, displacement, tilting or distress of the dam of appurtenant structures with the reservoir at its present level. There are no adverse conditions which would affect the stability of the dam at the present time.

6.2 DESIGN AND CONSTRUCTION DATA

No information could be located regarding the structural stability of the dam.

6.3 OPERATING RECORD

No operating records could be located for the structure. The sluice gate for draining the reservoir cannot be operated in its present condition.

6.4 POST-CONSTRUCTION CHANGES

There have been no post-construction changes to the dam. However, two of the three turbines have been removed, and the powerhouse has been abandoned.

6.5 SEISMIC STABILITY

The dam is located in Seismic Zone 3 and, in accordance with the recommended Phase I guidelines, a seismic stability analysis is warranted. This should be accomplished by a qualified registered professional engineer and should be made a part of the record for this dam.

6.6 STRUCTURAL STABILITY ANALYSIS

A structural stability analysis was conducted for the typical dam cross section. The results of the analysis are as follows:

Case	Description of Loading Conditions
1	Normal Operating Conditions, reservoir at elevation 297.0 MSL, full uplift, no tailwater.
2	Same as Case 1 plus 10 kips/L.F. ice load.
3	Water at 1/2 PMF elevation 311.53 MSL, uplift as in case 1, tailwater at elevation 280.7 MSL

Case	Factor of Safety Overturning	Location of Resultant From Toe	Factor of Safety Sliding
1	1.54	13.8	1.08
2	1.33	9.82	.96
3	.95	-3.10	.62

The location of the middle third of the dam foundation is 13.67 ft. to 27.33 ft. from the toe. A factor of safety of 1.5 for overturning, a resultant location within the middle third of the foundation, and a factor of safety of 3.0 for sliding is considered to be adequate by the Corps of Engineers guidelines. Therefore, it is recommended that an in-depth investigation of the structural stability of the dam be conducted. That investigation should include the following items:

1.   The reservoir level should be lowered below the spillway crest elevation to permit an inspection of the ogee spillway and the rock at the toe of the dam.

2.   The actual magnitude and distribution of hydrostatic uplift pressures under the dam should be determined by installing and monitoring piezometers.

3.   Core samples of the dam and foundation rock should be taken to determine in-situ material properties.

SECTION 7 - ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I Inspection of the Burt Dam did not reveal conditions which constitute an immediate hazard to the human life and property of the downstream residents.

From the available data the total spillway capacity is capable of discharging 10% of the PMF before overtopping of the dam occurs. This spillway is, therefore, judged to be inadequate.

The structural stability analysis performed as part of this investigation indicates the dam has safety factors against overturning and sliding below those recommended by the Corps of Engineers Guidelines.

b. Adequacy of Information

The information reviewed for this Phase I inspection is considered adequate.

c. Need for Additional Investigation

The following investigation is required to be performed by a qualified registered professional engineer:

1.   Investigate the normal and seismic stability of the dam and spillway.

d. Urgency

All recommended investigations should be completed within 12 months of notification to owner, and remedial actions resulting from these investigations completed in the subsequent 12 months. The remedial measures or actions listed below should be completed within one year from notification to owner.

7.2 RECOMMENDED REMEDIAL MEASURES

1.   Implement those remedial measures or actions resulting from the aforementioned investigation.

2.   Replace the missing floor grating on the bridge across the spillway.

3.   Paint the bridge across the spillway.

7-1

4. Install handrails the full length of the dam crest.

5. Repair the gate hoist controlling the reservoir drain gate.

6. Install fencing at the east abutment and post warning signs at both abutments to discourage trespassers.

7. Clear debris and vegetation from areas atop the downstream face of dam and from both abutments.

8. Implement a program of diligent and periodic maintenance including but not limited to: operation and lubrication of the reservoir drain, patching spalled and eroded concrete areas, and clearing debris and trash from trash racks and from upstream slopes.

9. Develop a formal written downstream warning system to alert the appropriate officials and residents in the event of an emergency.

10. Develop and maintain a program of biannual technical inspections.

APPENDIX A
VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) **Basic Data**

   a. **General**

   Name of Dam _____ Burt Dam _____

   Fed. I.D. # ____ 745 _____ DEC Dam No. __ 15C-272 _____

   River Basin ____ Lake Ontario _____

   Location: Town _ Burt _____ County _ Niagara _____

   Stream Name ____ Eighteenmile Creek _____

   Tributary of _____.

   Latitude (N) ___ 43° 18.8' _____ Longitude (W) ___ 78° 43.0' _____

   Type of Dam ___ Concrete Gravity _____

   Hazard Category ____ High _____

   Date(s) of Inspection ____ May 19, 1981 _____

   Weather Conditions _ Sunny, 70° _____

   Reservoir Level at Time of Inspection __ Elevation 297.5, 6 in. on spillway ____

   b. Inspection Personnel ____ Jim Reynolds, Ray Kampff, Jeff Hardin, Ken Avery, ___
   Bob Farrell, Rick Brown

   c. Persons Contacted (including Address & Phone No.) _ Attempted unsuccessfully
   to contact Olcott Harbor Board of Trade

   d. **History:**

   Date Constructed ___ 1924 _____ Date(s) Reconstructed _____

   Designer __ McCarthy Brothers and Company _____

   Constructed by ____ Same as Designer _____

   Owner ____ Olcott Harbor Board of Trade _____

") __Embankment__   Not applicable

a. Characteristics

   (1) Embankment Material_____

   _____

   (2) Cutoff Type_____

   _____

   (3) Impervious Core_____

   _____

   (4) Internal Drainage System_____

   _____

   (5) Miscellaneous_____

   _____

b. Crest

   (1) Vertical Alignment_____

   _____

   (2) Horizontal Alignment_____

   _____

   (3) Surface Cracks_____

   _____

   (4) Miscellaneous_____

   _____

c. Upstream Slope

   (1) Slope (Estimate) (V:H)_____

   (2) Undesirable Growth or Debris, Animal Burrows_____

   _____

   (3) Sloughing, Subsidence or Depressions_____

   _____

   _____

(4) Slope Protection_____

_____

_____

(5) Surface Cracks or Movement at Toe_____

_____

d. Downstream Slope

(1) Slope (Estimate - V:H)_____

(2) Undesirable Growth or Debris, Animal Burrows_____

_____

(3) Sloughing, Subsidence, or Depressions_____

_____

_____

(4) Surface Cracks or Movement at Toe_____

_____

(5) Seepage_____

_____

_____

(6) External Drainage System (Ditches, Trenches, Blanket)_____

_____

_____

(7) Condition Around Outlet Structure_____

_____

(8) Seepage Beyond Toe_____

_____

e. Abutments - Embankment Contact

_____

_____

_____

(1) Erosion at Contact_____

_____

(2) Seepage Along Contact_____

_____

_____

A-4

3) Drainage System

    (a) Description of System___None noted_____

_____

_____

    (b) Condition of System_____

_____

_____

    (c) Discharge from Drainage System_____

_____

_____

4) Instrumentation (Momumentation/Surveys, Observation Wells, Weirs, Piczometers,
etc.)___None noted_____

_____

_____

_____

5) Reservoir

    a. Slopes___Generally good condition_____

_____

    b. Sedimentation___Could not be observed_____

_____

    c. Unusual Conditions Which Affect Dam___None_____

_____

6) Area Downstream of Dam

    a. Downstream Hazard (No. of homes, highways, etc)___Many structures in Olcott,___
See Table 5.1 for Summary of Downstream Impacts._____

    b. Seepage, unusual growth___Many trees in and along channel_____

_____

    c. Evidence of movement beyond toe of Dam___None noted_____

_____

    d. Conditions of Downstream Channel___Rock strewn, stable_____

_____

A-5

Spillway(s) (including Discharge Conveyance Channel)

_____ Spillway could not be inspected because of flow over it _____

_____

a.   General _____ Side walls are spalled _____

_____

_____

b.   Condition of Service Spillway _Good based on what could be seen_ .

_____

_____

c.   Condition of Auxiliary Spillway _____ Not applicable _____

_____

_____

d.   Condition of Discharge Conveyance Channel _____

_____

_____

Reservoir Drain/Outlet

Type: Pipe _____ Conduit _____ Other _6' x 6' penetration thru spillway_

Material: Concrete _____ Metal _____ Other _____

Size: _6' x 6'_ _____ Length _Approx 40'_ _____

Invert Elevations: Entrance _252 ft._   Exit _252 ft._

Physical Condition (Describe):   Unobservable _X_

    Material: _____

    Joints: _____ Alignment _____

    Structural Integrity: _____

    Hydraulic Capability: _____

    Means of Control: Gate _X_   Valve _____ Uncontrolled _____

        Operation: Operable _____ Inoperable _X_ Other _____

        Present Condition (Describe): _____

9. <u>Structural</u>

a. Concrete Surfaces___Spalling significant on crest, spillway sidewalls and downstream face

b. Structural Cracking_____Minor

c. Movement - Horizontal & Vertical Alignment (Settlement)___None observed

d. Junctions with Abutments or Embankments___Could not inspect

e. Drains - Foundation, Joint, Face_____None

f. Water Passages, Conduits, Sluices___Could not inspect reservoir drain water passage

g. Seepage or Leakage___Seepage observed along west side of west spillway side wall. May be ground water.

h. Joints - Construction, etc.___Effervesance observed along same construction joints. No leakage.

i. Foundation_____On rock. Could not inspect near dam due to high water.

j. Abutments___Covered with earth, trees and vegetation

k. Control Gates___Inoperative

l. Approach & Outlet Channels___Not applicable

m. Energy Dissipators (Plunge Pool, etc)____None_____

_____

n. Intake Structures_____Not applicable_____

_____

_____

o. Stability_____Good. No problems observed_____

_____

_____

p. Miscellaneous_____

_____

_____

10) Appurtenant Structures (Power House, Lock, Gatehouse, Other)

a. Description and Condition____Power House abandoned but in good condition____

_____

_____

_____

_____

APPENDIX B

ENGINEERING DATA

APPENDIX B

B-1

POWER

FLOOR ELEV

SPILLWAY

1·C"

GATE HOI

255

260

265

R HOUSE

UNIT 1   UNIT 2

ELEV. 280.00

ELEV. 30

GATE
HOISTS

TRASH RACK   TRASH RACK

3

270

280
285
290
295
300

275

ELEV. 304.5

4

PL

280 285 290 295 300 305 310 315 320

75

TOP OF BANK

PLOT PLAN

B-2

SPILLWAY SECTION

75'-0"

4'-0"

18 x [?]

1½"∅ W.I.

7'-0"

10" I.

Sluice
Gate 2   6" x   6"

Rock Line

∂
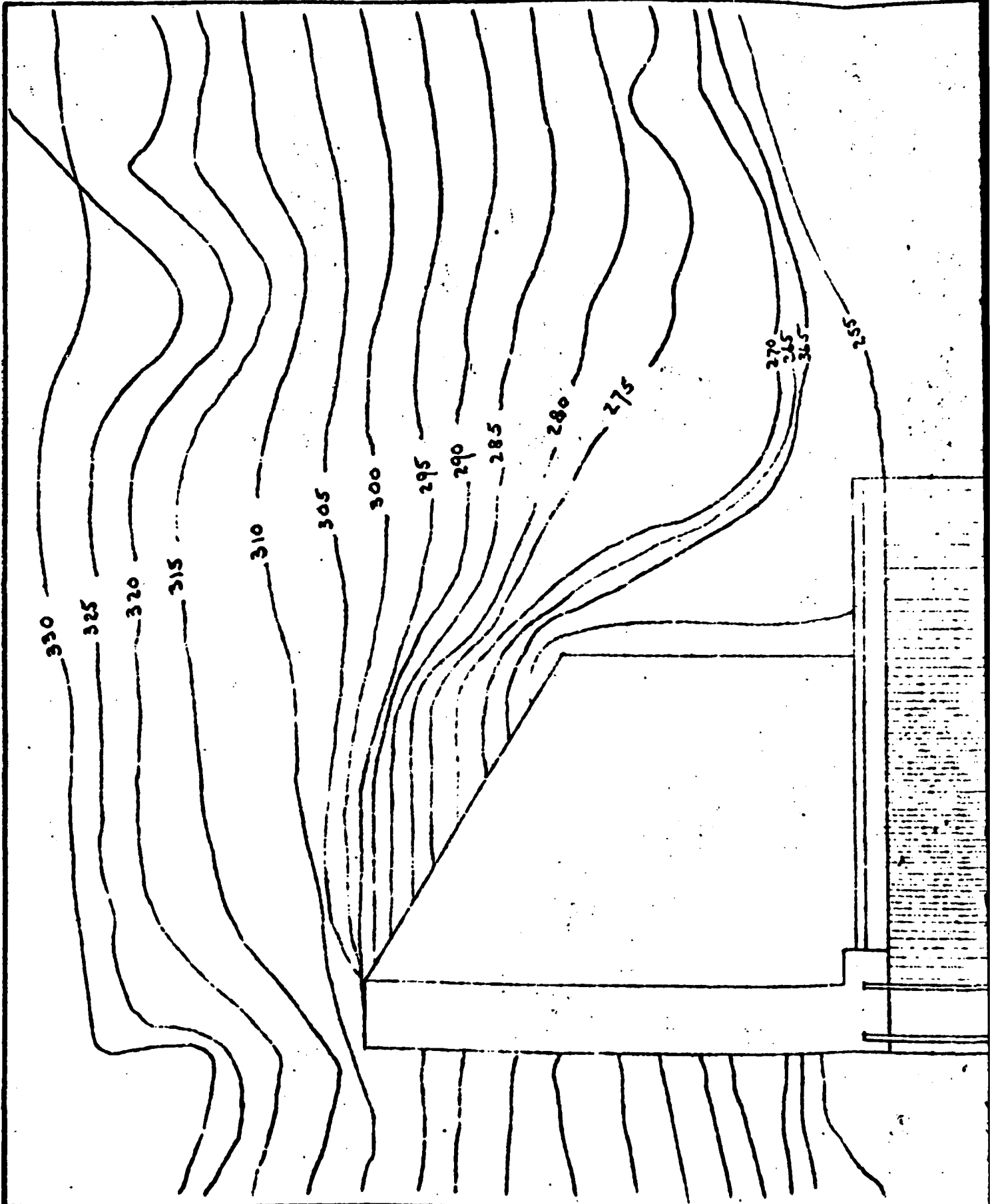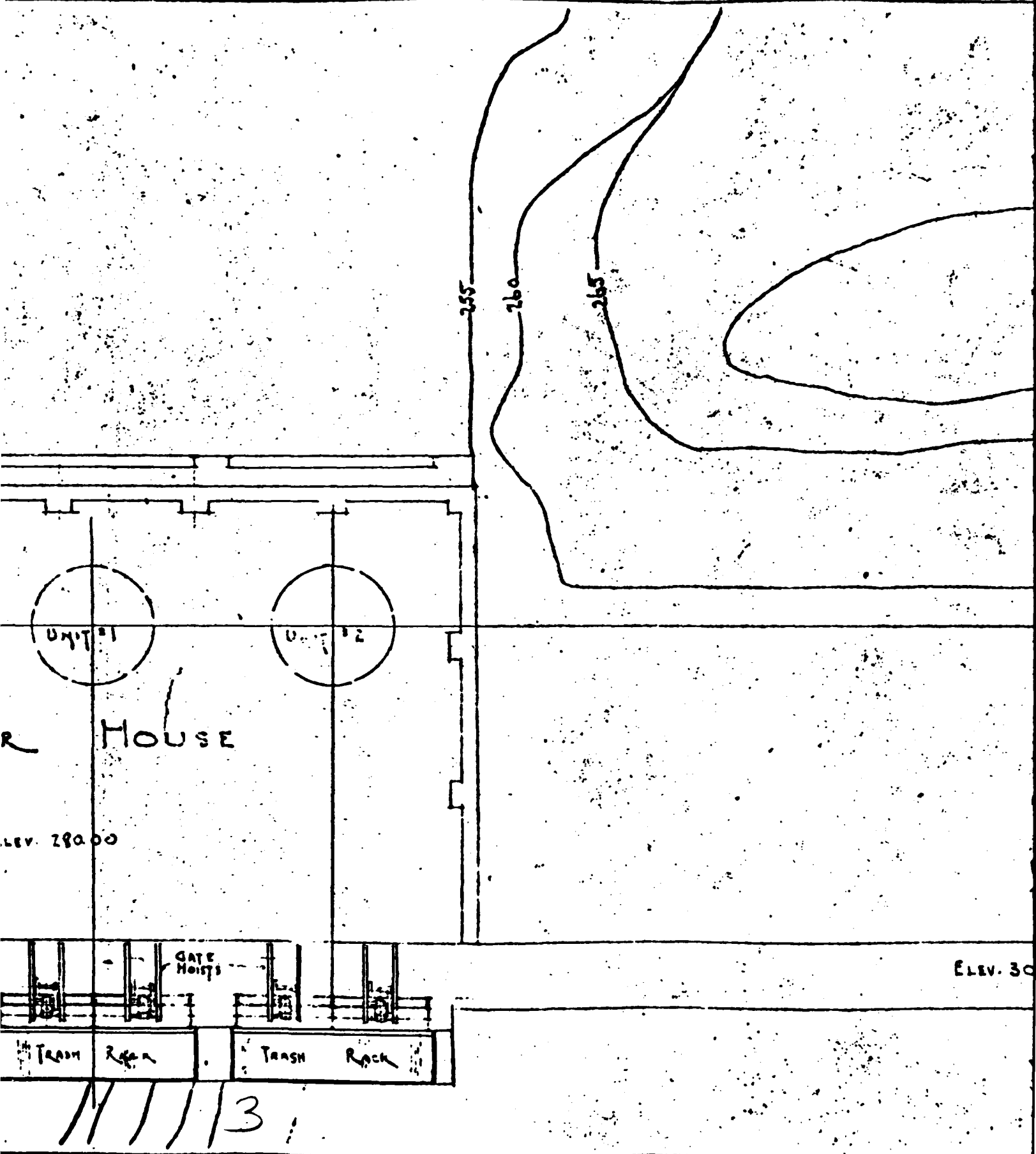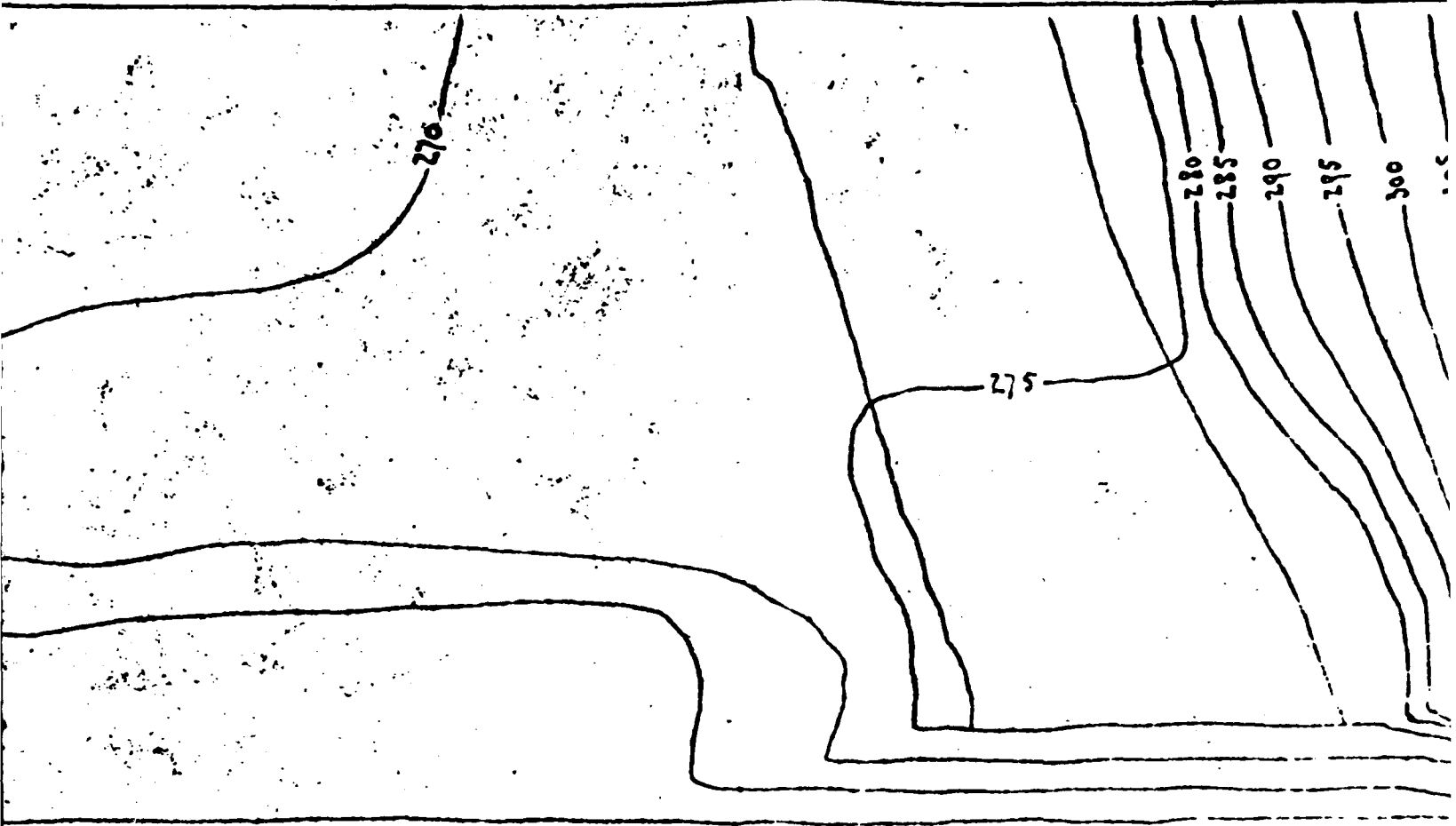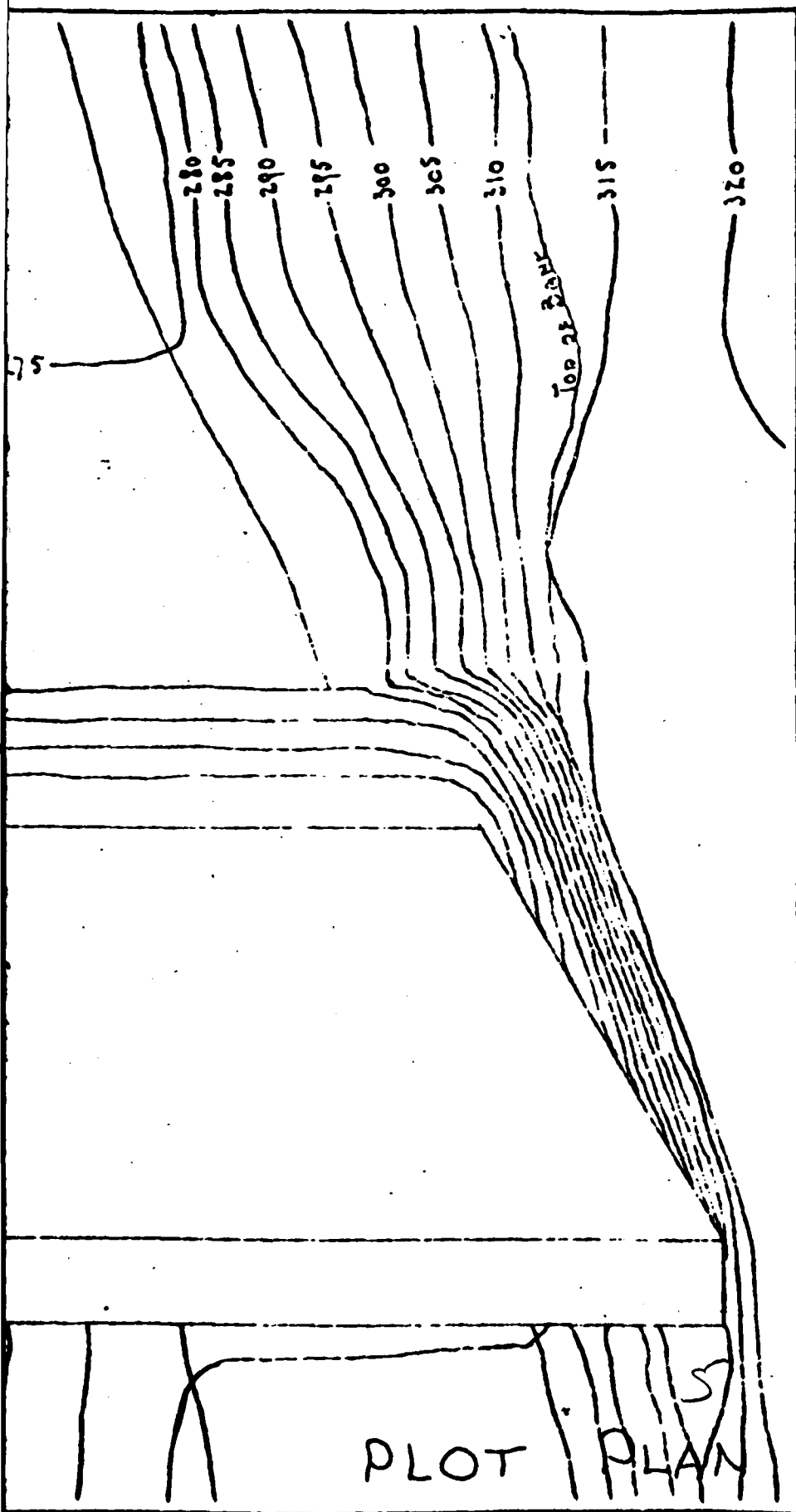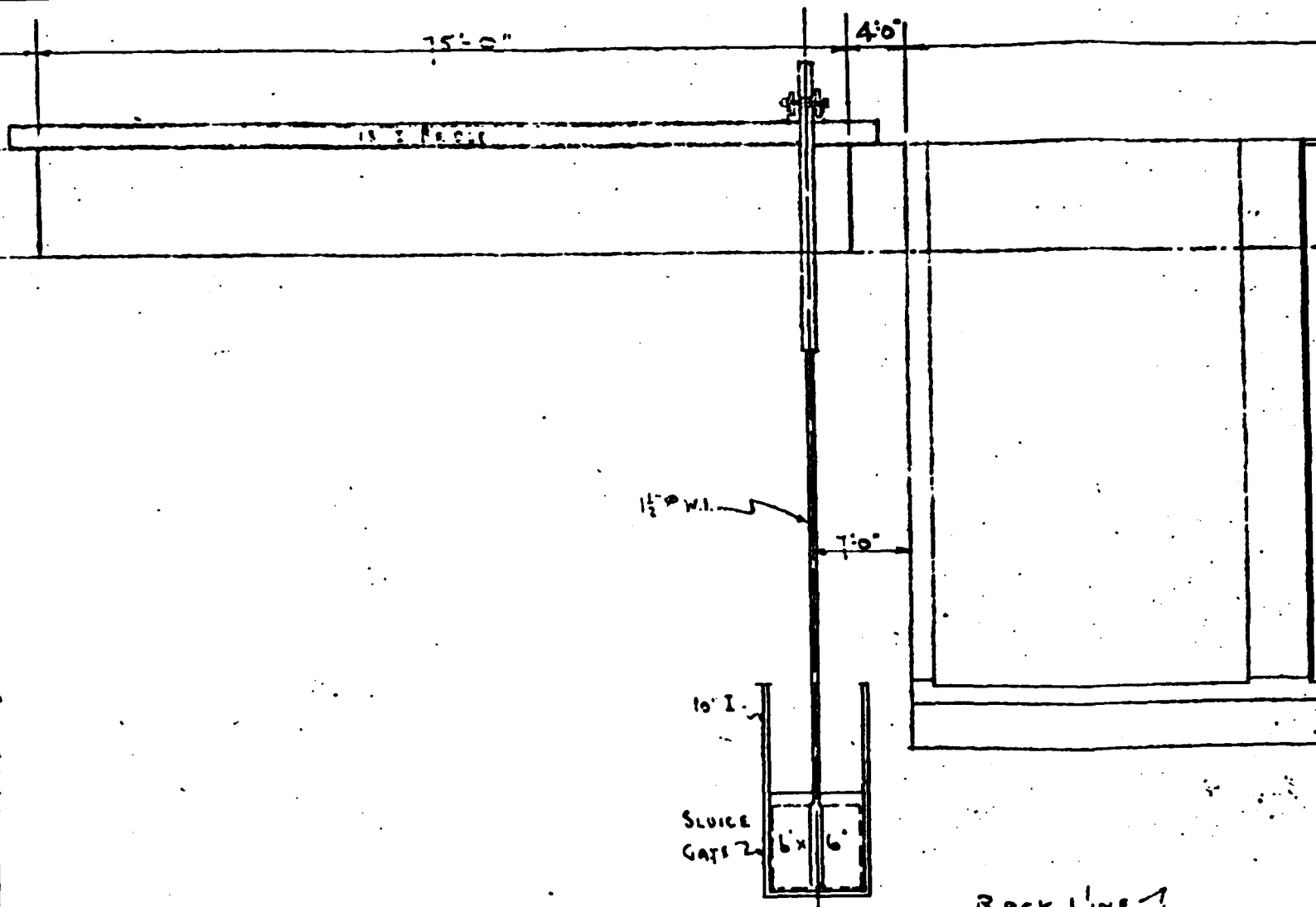
324'.0"

68'.0"

ELEV. 304.5

NORMAL WATER LEVEL ELEV. 297.00

GATE   GATE

PRESENT EARTH FILL

3

REAM ELEVATION

131'-0"

5'-0"

NOTE
EXCAVATION TO BE CARRIED DOWN
TO SOUND ROCK, AND INTO BANKS TO
SOUND ROCK AS DIRECTED

41'-0"

23'-9"

41'-0"

4
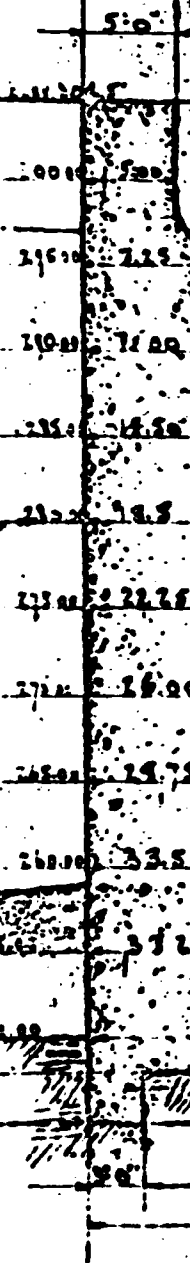
DAM SECTION

RRIED DOWN
INTO BANKS TO
TED

CAVISES 5-6-26 A-304-14
REVISED A-26-24 A-304-8
REVISED 4-16-24 A-304-6
REVISED 4-13-24 A-304-4
REVISED 3-15-- 243-44
REVISED 4-2-3 2-59-12

PROPOSAL No. 3556	CONTRACT No.

McCARTHY BROS & FORD
BUFFALO N.Y.

PLAN OF DAM
HYDRO ELECTRIC POWER DEVELOPMENT
LOCKPORT & NEWFANE POWER & WATER SUPPLY CO.
MIDDLEPORT N.Y.

DATE	APRIL 3 '23	SCALE	N.T.S.
CHECKED			
DRAWN		1332	E

S

APPENDIX C

PHOTOGRAPHS
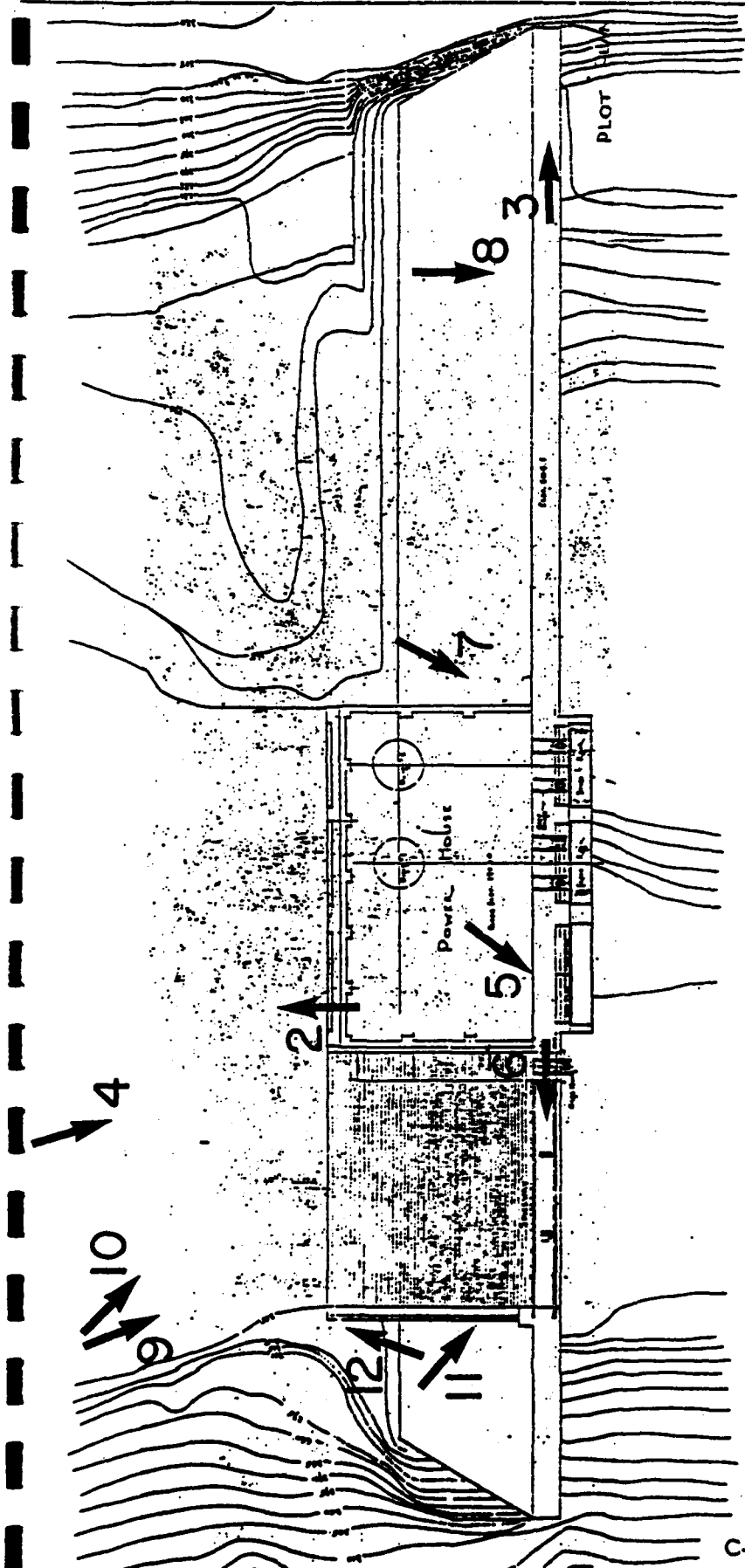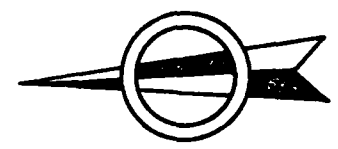
BURT DAM

NYO0745

PHOTO ORIENTATION PLAN

ERDMAN, ANTHONY, ASSOCIATES
CONSULTING ENGINEERS & PLANNERS

DATE   MAY 1981

C-1
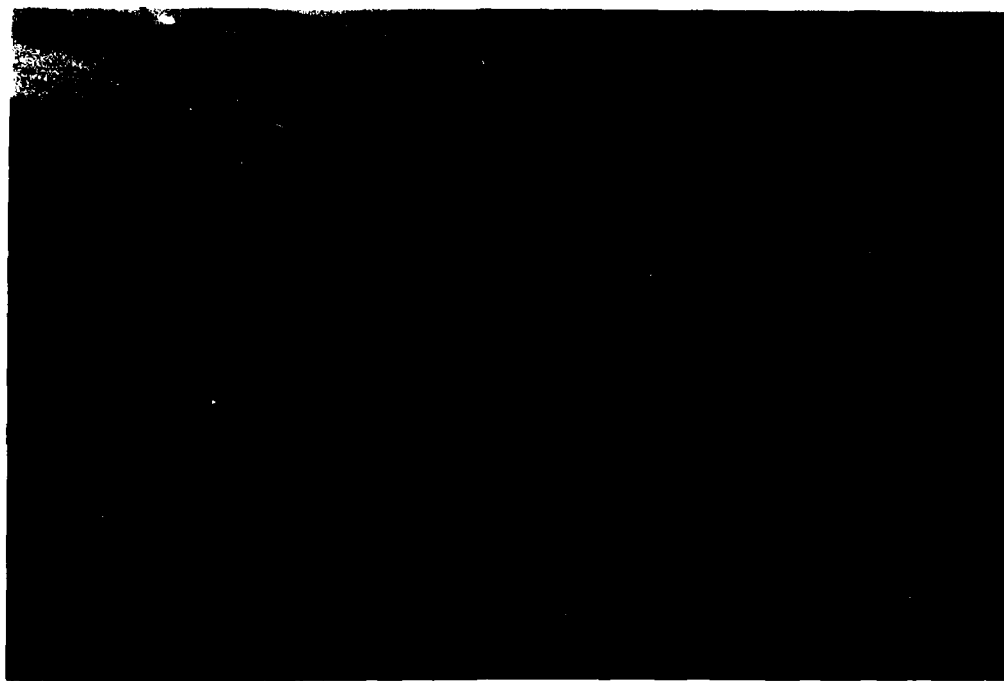
1. Upstream impoundment
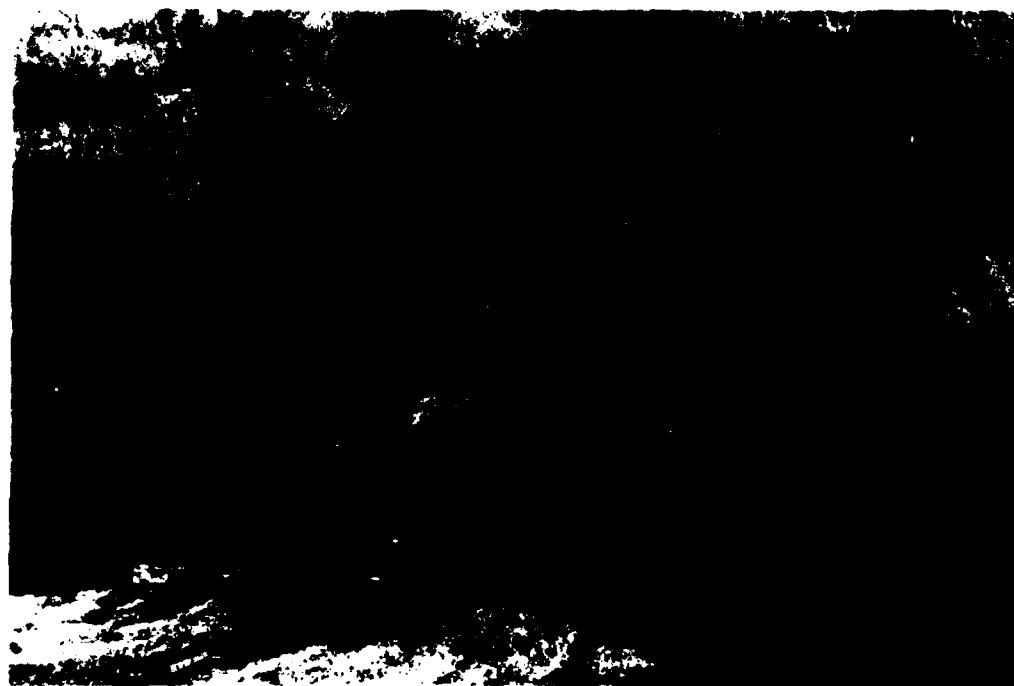
2. Downstream channel
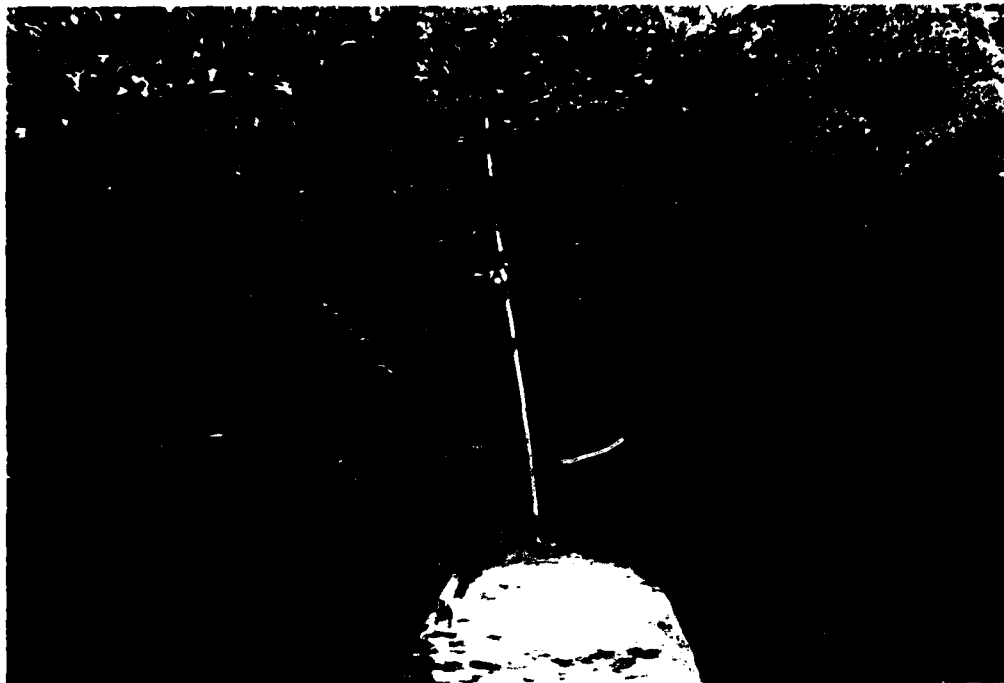
3. Stairs at east abutment

4. Abandoned powerhouse

5. Sluice gate mechanism for penstocks

6. Bridge across spillway. Note missing grating.
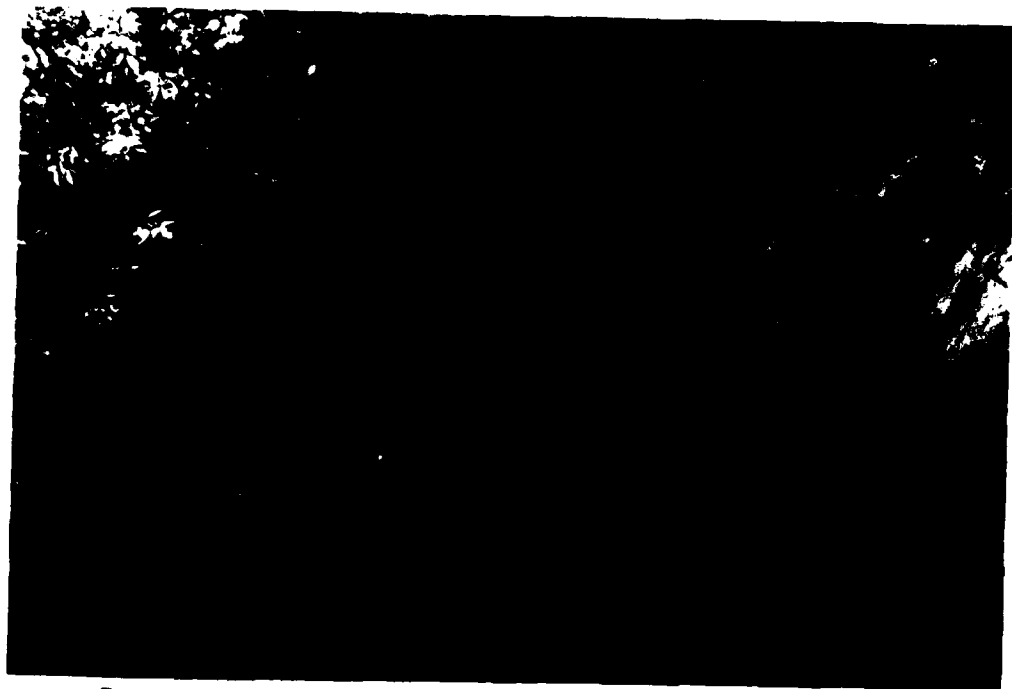
7. Downstream face of dam near east abutment.
Note spalled concrete.

8. Downstream face of dam east
of abandoned powerhouse.
Note spalled concrete and
effervesce.

C-5
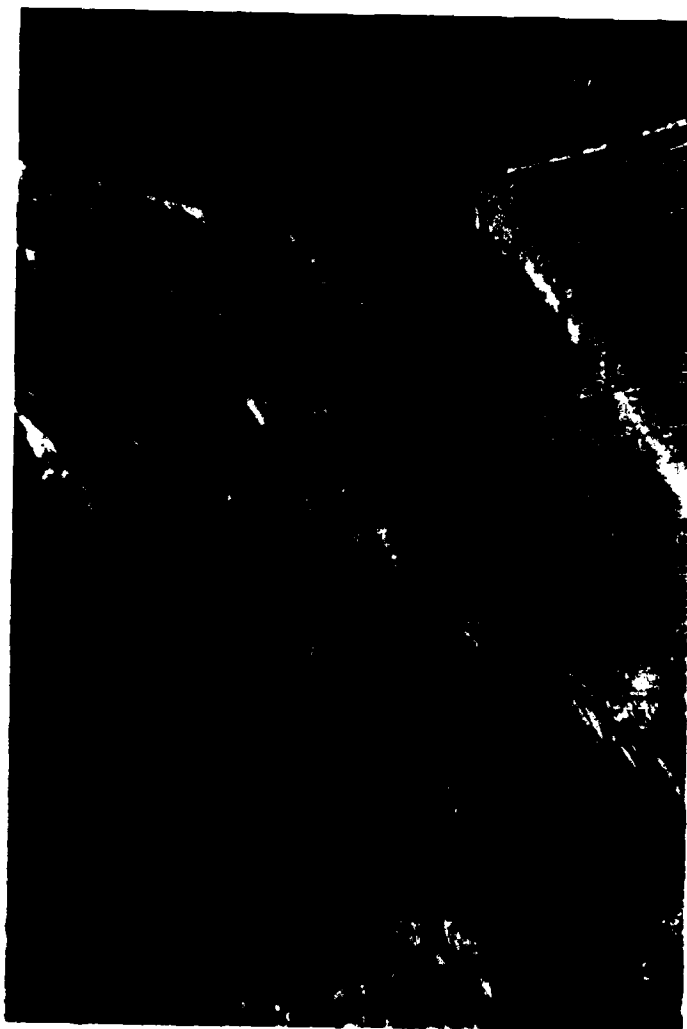
9. Spillway

10. Abandoned powerhouse
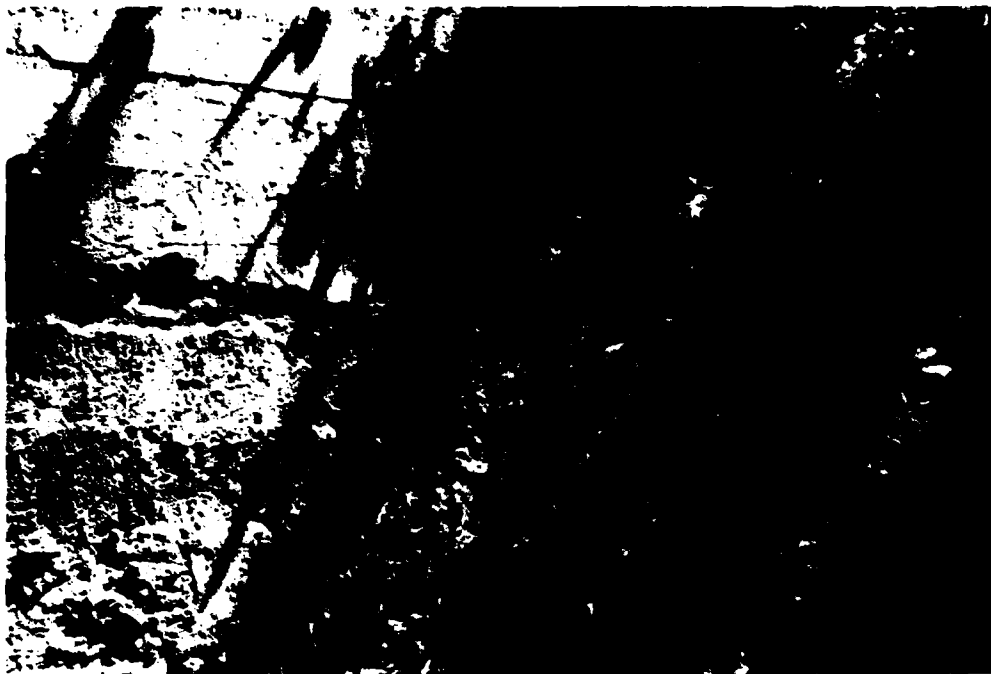
11. West face of west spillway wall. Note water trickling down face of dam.

12. West face of west spillway wall. Note spalled concrete.

APPENDIX D

HYDRAULIC AND HYDROLOGIC COMPUTATIONS

A P P E N D I X D

Burt Dam

CROSS SECTION LOCATION PLAN

Scale: 1" = 2000'

D-2

```
A1    ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF        DAM NY 745
A1    HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF BURT DAM
A2    RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
A3
B     100       0                                     0          0         -1
B1      5
J1      1        .6        .5        .6        .8      1          0          0
J1      .2        .4                                   0          1          0
K1    COMPUTE HYDROGRAPH FOR SUB-AREA 1
R       1      39.22               101       77.4      125
P       0      21.8      91        112                          1.        .1       0
J      9.29      .63
P      2.       -.1                         2.
P      -.2
K1    COMPUTE HYDROGRAPH FOR SUB-AREA 2
R       1      20.               101         0         0          1          0
P       0      21.8      91        112                          1.        .1       0
P      2.      -.1                          2.
K1      5.31    0.63                          0         0          1          0
P      2.      -.1                          A
K1    COMBINE HYDROGRAPHS FROM SUB-AREAS 1 AND 2 AT POINT A
K1      1         R                          0          0          0
K1    ROUTE THE COMBINED HYDROGRAPH FROM POINT A TO B BY MUSKINGUM METHOD
Y       1        C        0        0.15      0.2       0         -1          -1
K       0        3                                                1
K1    COMPUTE HYDROGRAPH FROM SUB-AREA 4
R       1      18.17              101        77.4      125
P       0      21.8      91        112                          1.        .1       0
P      5.64    0.63
P      2.      -.1                          2.
K1    COMBINE ALL HYDROGRAPHS AT POINT B - INFLOW TO RESERVOIR
K1      1 OUTFLOW                                      1
K1    CALCULATION OF OUTFLOW HYDROGRAPH FROM RESERVOIR
Y                           1          1         -297.              -1
V1      1
V4    297.0   298.0   299.0   300.0   301.0   302.0   303.0   304.0   304.5   305.0
V4    307.0   309.0   311.0   313.0   315.0   317.0   319.0   320.0
Y5      0       29R     842     1547    2382    3329    4376    5514    6116    6737
V5    9416    12377   15597   19056   22738   30725   32843
SA      0.      95.     129     174     225
SE    250.    297.             310     320
SS    297.
SD    304.5
SL    253.3   315.3
SV    304.5   320.0
K       1         1                                    1
K1    CHANNEL ROUTING -MOD PULS RESERVOIR - 1
Y                           1          1
V1      1
V6    0.1     0.045     0.1     254     300     500    0.0022
V7      0       30C      60     256     270     256     380     300       341     300
V7    382     300      3R3     300
```

D-3

```
A1    ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF

K       1       2                                                    1
KI    CHANNEL ROUTING -MOD PULS REACH 1-2
Y                       2                                    1
Y1      1               1
Y6      0.045    0.1    254    800    0.0022
Y7      300      110    254    254    400          300    401    300
Y7      402      403    300    300

KI    CHANNEL ROUTING -MOD PULS REACH 2-3
Y                       1                                    1
Y1      1               1
Y6      0.045    0.1    251    1300   0.0022
Y7      300      150    263    251    480          251    510    260
Y7      500      501    300    300

KI    CHANNEL ROUTING -MOD PULS REACH 3-4
Y                       1                                    1
Y1      1               1
Y6      0.045    0.1    249    1100   0.0022
Y7      300      120    260    249    500          249    520    260
Y7      600      601    300    300

KI    CHANNEL ROUTING -MOD PULS REACH 4-5
Y                       2                                    1
Y1      1               1
Y6      0.045    0.1    245    1800   0.0022
Y7      300      100    250    245    500          245    505    250
Y7      630      631    300    300

KI    CHANNEL ROUTING -MOD PULS REACH 5-6
Y                       1                                    1
Y1      1               1
Y6      0.045    0.1    241    1700   0.0022
Y7      290      105    250    241    520          241    550    250
Y7      630      631    290    290

KI    CHANNEL ROUTING -MOD PULS REACH 6-7
Y                       1                                    1
Y1      1               1
Y6      0.06     0.06   238    1600   0.0022
Y7      270      450    260    250    650          238    1040   238
Y7      1060     1590   280    280

KI    CHANNEL ROUTING -MOD PULS REACH 7-8
Y                       2                                    3
Y1      1               1
Y6      0.06     0.06   235    1400   0.0022
Y7      260      80     250    235    1300         235    1800   250
Y7      2300     2550   270    270
K       99
A
```

D-4

OK. SEG #HEC1DB

OK. SEG #HEC1DB
ENTER PROJECT NUMBER
88166-08-11
INPUT FILE 7 NY745

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION   JULY 1978
    LAST MODIFICATION 26 FEB 79
****

1   PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

            RUNOFF HYDROGRAPH AT   1
            RUNOFF HYDROGRAPH AT   2
            COMBINE 2 HYDROGRAPHS AT   A
            ROUTE HYDROGRAPH TO   B
            RUNOFF HYDROGRAPH AT   3
            COMBINE 2 HYDROGRAPHS AT   B
            ROUTE HYDROGRAPH TO   OUTFLOW
            ROUTE HYDROGRAPH TO   1
            ROUTE HYDROGRAPH TO   2
            ROUTE HYDROGRAPH TO   3
            ROUTE HYDROGRAPH TO   4
            ROUTE HYDROGRAPH TO   5
            ROUTE HYDROGRAPH TO   6
            ROUTE HYDROGRAPH TO   7
            ROUTE HYDROGRAPH TO   8
            END OF NETWORK

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION   JULY 1978
    LAST MODIFICATION 26 FEB 79
****

RUN DATE: 8/11/
    TIME: 1:54 PM

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF   DAM NY 745
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF BURT DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM

                          JOB SPECIFICATION
NO   NHR   NMIN   IDAY   IHR   IMIN   METRC   IPLT   IFRT   NSTAN
100   1   0   0   0   0   0   -1   4   0
                 JOPER NWT LROPT TRACE
                   5   0   0   0

                 MULTI-PLAN ANALYSES TO BE PERFORMED
                 NPLAN= 1 NRTIO= 6 LRTIO= 1
RTIOS= 0.20   0.40   0.50   0.60   0.80   1.00

**********   **********   **********   **********

                     SUB-AREA RUNOFF COMPUTATION

D-5

COMPUTE HYDROGRAPH FOR SUB-AREA 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
1		0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSOA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
2	1	39.22	0.00		77.40	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.80	91.00	101.00	112.00	125.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.861

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 9.29 CP=0.63 NTA= 0

RECESSION DATA

STRTQ= 2.00 QRCSN= -0.10 RTIOR= 2.00

UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG= 9.23 HOURS, CP= 0.63 VOL= 1.00

60.	223.	450.	710.	990.	1268.	1502.	1665.	1755.	1766.
1668.	1496.	1327.	1177.	1044.	926.	821.	729.	646.	573.
508.	451.	400.	355.	315.	279.	248.	220.	195.	173.
153.	136.	121.	107.	95.	84.	75.	66.	55.	52.
46.	41.	36.	32.	29.	25.	23.	20.	18.	16.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS		MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 23.46 19.60 3.86 500602.
(556.)(492.)(98.)(144507.65)

********* *********

SUB-AREA RUNOFF COMPUTATION

********* *********

COMPUTE HYDROGRAPH FOR SUB-AREA 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
2		0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	20.30	0.00	77.40	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.80	91.00	101.00	112.00	125.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.861

LOSS DATA

OK, SEG #HEC1DB

```
 LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
   0    0.00   0.00   1.00   0.00   0.00   1.00   1.00   0.10   0.00   0.00
```

UNIT HYDROGRAPH DATA
```
        TP= 5.31     CP=0.63    NTA= 0
```

RECESSION DATA
```
    STRTQ=  2.00    QRCSN= -0.10    RTIOR= 2.00
```

UNIT HYDROGRAPH 29 END-OF-PERIOD ORDINATES, LAG=   5.34 HOURS, CP= 0.64 VOL= 1.00
```
 118.   401.   787.  1172.  1444.  1534.  1403.  1153.   933.   755.
 611.   495.   401.   324.   262.   212.   172.   139.   113.    91.
  74.    60.    48.    39.    32.    26.    21.    17.    14.
```

END-OF-PERIOD FLOW
```
MO.DA HR.MN PERIOD  RAIN  EXCS  LOSS  COMP Q      MO.DA HR.MN PERIOD  RAIN  EXCS  LOSS  COMP Q
  0
MO.DA HR.MN PERIOD  RAIN  EXCS  LOSS  COMP Q

                    SUM  23.46 19.60  3.86   273626.
                      ( 596.)( 498.)( 98.)( 7748.22)
```

****

COMBINE HYDROGRAPHS

****

COMBINE HYDROGRAPHS FROM SUB-AREAS 1 AND 2 A1 POINT A
```
 ISTAQ  ICOMP  IECON  ITAPE  JPLT  JPRT  INAPE  ISTAGE  IAUTO
   A      2      0      0      0     0     1      0       0
```

****

HYDROGRAPH ROUTING

****

ROUTE THE COMBINED HYDROGRAPH FROM POINT A TO B BY MUSKINGUM METHOD
```
 ISTAQ  ICOMP  IECON  ITAPE  JPLT  JPRT  INAPE  ISTAGE  IAUTO
   B      1      0      0      0     0     1      0       0
```

ROUTING DATA
```
  IRES  ISAME  IOPT              IPMP     LSTR
   0      0      1                0        0

 NSTPS  NSTDL  LAG   AMSKK   X      TSK    STORA  ISPRAT
   1      0     1    0.150  0.200  0.000    -1.     0

 QLOSS  CLOSS  AVG
  0.0   0.000  0.00
```

****

SUB-AREA RUNOFF COMPUTATION

****

COMPUTE HYDROGRAPH FROM SUB-AREA 4
```
 ISTAQ  ICOMP  IECON  ITAPE  JPLT  JPRT  INAPE  ISTAGE  IAUTO
   3      0      0      0      0     0     1      0       0
```

HYDROGRAPH DATA

OK: SEG BHEC1D8

	IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
	1	1	18.17	0.00	77.40	0.00	0.000	0	1	0

PRECIP DATA

	SPFE	PMS	R6	R12	R24	R48	R72	R96
	0.00	21.60	91.00	101.00	112.00	125.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.661

LOSS DATA

	LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSHX	RTIMP
	0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	6.00	0.00

UNIT HYDROGRAPH DATA

TP= 5.64   CP=0.63   NTA= 0

RECESSION DATA

STRTQ= 2.00   QRCSN= -0.10   RTIOR= 2.00

UNIT HYDROGRAPH 31 END-OF-PERIOD ORDINATES, LAG= 5.65 HOURS, CP= 0.63   VOL= 1.00

89.	325.	641.	966.	1209.	1313.	1240.	1049.	864.	711.
586.	482.	397.	327.	269.	221.	182.	150.	124.	102.
84.	69.	57.	47.	38.	32.	26.	21.	18.	15.
12.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM   23.46   19.60   3.86   246782.
(596.)(498.)(98.)(6988.08)

****

COMBINE HYDROGRAPHS

COMBINE ALL HYDROGRAPHS AT POINT B - INFLOW TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT
B	2	0	0	0	0

****

HYDROGRAPH ROUTING

CALCULATION OF OUTFLOW HYDROGRAPH FROM RESERVOIR

UTFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
	1	0	0	0	1	0	0	0

ROUTING DATA

IRES	ISAME	IOPT	X	LSTR
1	1	0	0.000	0

QLOSS	AVG	LAG	AMSKK	X
0.00	0.00	0	0.000	0.000

NSTPS	NSTDL	TSK	STORA	ISPRAT
1	3	0.000	-297.	-)

STAGE	297.00	298.00	299.00	300.00	301.00	302.00	303.00	304.00	304.50	305.00

D-8

```
                307.00    309.00    311.00    313.00    315.00    317.00    315.00    320.00

FLOW      0.00    298.00    842.00   1547.00   2382.00   3329.00   4376.00   5514.00   6116.00   6737.00
       9416.00  12377.00  15597.00  19056.00  22738.00  30725.00  32841.00      0.00

SURFACE AREA=     0.      95.     129.     174.     225.
   CAPACITY=      0.    1488.    1823.    3332.    5322.
  ELEVATION=    250.     297.     300.     310.     320.

              CREL    SPWID    COQW    EXPW    ELEVL    COQL    CAREA    EXFL
              297.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                          DAM DATA
                                 COQD    EXPD    DAMWID
                                 0.0     0.0      0.
                         TOPEL
                         304.5

CREST LENGTH       253.      315.
AT OR BELOW
ELEVATION         304.5     320.0

PEAK OUTFLOW IS   13055. AT TIME   47.00 HOURS
PEAK OUTFLOW IS   26210. AT TIME   47.00 HOURS
PEAK OUTFLOW IS   32785. AT TIME   47.00 HOURS
PEAK OUTFLOW IS   39351. AT TIME   47.00 HOURS
PEAK OUTFLOW IS   52640. AT TIME   47.00 HOURS
PEAK OUTFLOW IS   65687. AT TIME   47.00 HOURS
```

```
**********    **********    **********    **********

                     HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS RESERVOIR - 1
          ISTAQ  ICOMP  IECON  ITAPE   JPLT   JPRT   INAPE  ISTAGE  IAUTO
            1      1       0      0      0      0       1      0       0
                               ROUTING DATA
          QLOSS  CLOSS   AVG    IRES   ISAME  IOPT   IPMP    TSK    STORA  ISPRAT
           0.0   0.000   0.00    1      1      0      0     0.000    0.      0

          NSTPS  NSTDL          LAG    AMSKK   X            TSK    STORA  ISPRAT
            1      0              0    0.000  0.000        0.000    0.      0
```

NORMAL DEPTH CHANNEL ROUTING

```
QN(1)   QN(2)   QN(3)    FLRVT   ELMAX   RLNTH    SEL
0.1300  0.0450  0.1000   256.0   300.0   500.   0.00220
```

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
```
  0.00  300.00   80.00  256.00  270.00  256.00  380.00  300.00  381.00  300.00
382.00  300.00  383.00  384.00  380.00  300.00
```

STORAGE	0.00	5.18	10.63	16.35	22.33	28.57	35.09	41.86	46.91	56.22
	63.79	71.64	79.74	88.12	96.75	105.66	114.83	124.27	133.97	143.93

OUTFLOW	0.00	550.08	1784.35	3582.54	5909.21	8750.48	12102.24	15965.71	20345.37	25247.81
	30681.13	36654.48	43177.70	50261.23	57915.95	66153.00	74983.77	84419.83	94472.84	105154.67

STAGE	256.00	258.32	260.63	262.95	265.26	267.58	269.89	272.21	274.53	276.84
	279.16	281.47	283.79	286.10	288.42	290.74	293.05	295.37	297.68	300.00

FLOW	0.00	550.08	1784.35	3582.54	5909.21	8750.48	12102.24	15965.71	20345.37	25247.81
	30681.13	36654.48	43177.70	50261.23	57915.95	66153.00	74983.77	84419.83	94472.84	105154.67

MAXIMUM STAGE IS   270.5

MAXIMUM STAGE IS   277.2

MAXIMUM STAGE IS   280.0

MAXIMUM STAGE IS   282.4

MAXIMUM STAGE IS   286.8

MAXIMUM STAGE IS   290.6

**********   **********   **********   **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 1-2

ISTAQ	ICOMP	ICCON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

IRES	ISAME	IOPT	IPMP	LSTR
1	1	0	0	0

QLOSS	CLOSS	AVG	AMSKK	X	TSK	STORA	ISPRAT
0.0	0.000	0.00	0.000	0.000	0.000	0.	0

NSTPS	NSTDL	LAG
1	0	0

****

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1008	0.0450	0.1000	254.0	300.0	800.	0.00220

CROSS SECTION COORDINATES--STA,CLEV,STA,ELEV--ETC
```
  0.00  300.00  110.00  254.00  240.00  254.20  400.00  300.00  401.00  300.00
```

OK, SEG DHEC108

	402.00	300.00	403.00	300.00	404.00	300.00			
STORAGE	0.00	6.10	12.62	20.18	28.18	36.80	46.05	55.94	66.46	77.61
	89.39	101.81	114.85	128.53	142.84	157.78	173.36	189.56	206.40	223.87
OUTFLOW	0.00	416.20	1384.43	2846.60	4802.55	7265.58	10254.60	13791.18	17898.35	22595.87
	27919.85	33882.56	40512.32	47833.27	55869.49	64644.81	74182.94	84507.27	95641.02	117607.20
STAGE	254.00	256.42	258.84	261.26	263.68	266.11	268.53	270.95	273.37	275.79
	278.21	280.63	283.05	285.47	287.89	290.32	292.74	295.16	297.58	300.00
FLOW	0.00	416.20	1384.43	2846.60	4802.55	7265.58	10254.60	13791.18	17898.35	22595.87
	27919.85	33882.56	40512.32	47833.27	55869.49	64644.81	74182.94	84507.27	95641.02	117607.20

MAXIMUM STAGE IS   270.4

MAXIMUM STAGE IS   277.4

MAXIMUM STAGE IS   280.2

MAXIMUM STAGE IS   282.6

MAXIMUM STAGE IS   286.9

MAXIMUM STAGE IS   290.6

**********   **********   **********   **********   **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 2-3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

	IRES	ISAME	IOPT	IPPP		LSTR
	1	1	0	0		0

QLOSS	CLOSS	AVG	X	TSK	STORA	ISPRAT
0.0	0.000	0.00	0.000	0.000	0.	0

	NSTPS	NSTDL	LAG	AMSKK	
	1	0	0	0.000	

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1090	251.0	300.0	1300.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00	300.00	150.00	260.00	210.00	251.00	480.00	251.00	510.00	260.00
500.00	300.00	501.00	300.00	502.00	300.00				

STORAGE	0.00	21.77	45.53	71.21	98.24	126.08	154.67	184.00	214.08	244.90
	276.47	308.77	341.83	375.63	410.17	445.46	481.49	518.26	555.78	594.05

D-11

OK, SEG #HEC10B

OUTFLOW	0.00	2061.09	6632.64	13345.73	22009.40	32417.48	44443.73	58013.29	73065.88	89565.48
	107476.98	126763.97	147406.63	169385.53	192684.06	217288.41	243186.94	270369.44	298827.63	328554.31
STAGE	251.00	253.58	256.16	258.74	261.32	263.89	266.47	269.05	271.63	274.21
	276.79	279.37	281.95	284.53	287.10	289.68	292.26	294.84	297.42	300.00
FLOW	0.00	2061.09	6632.64	13345.73	22009.40	32417.48	44443.73	58013.29	73069.88	89565.48
	107476.98	126763.97	147406.63	169385.53	192684.06	217288.41	243186.94	270369.44	298827.63	328554.31

MAXIMUM STAGE IS 258.6

MAXIMUM STAGE IS 262.3

MAXIMUM STAGE IS 264.0

MAXIMUM STAGE IS 265.4

MAXIMUM STAGE IS 268.0

MAXIMUM STAGE IS 270.4

**********   **********   **********   **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 3-4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ROUTING DATA

IRES	ISAME	IOPT	X
1	1	0	0.000

QLOSS	CLOSS	AVG
0.0	0.000	0.00

NSTPS	NSTDL	LAG	AMSKK	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1030	0.0450	0.1000	249.0	300.0	1100.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV,STA,ELEV--ETC

| 0.00 | 300.00 | 120.00 | 260.00 | 190.00 | 249.00 | 500.00 | 249.00 | 520.00 | 260.00 |
| 600.00 | 300.00 | 601.00 | 300.00 | 602.00 | 300.00 | | | | |

STORAGE	0.00	21.76	45.00	69.74	95.96	123.44	151.82	181.12	211.33	242.45
	274.48	307.41	341.26	376.02	411.68	448.26	485.74	524.14	563.44	603.66
OUTFLOW	0.00	2518.29	8266.79	15998.30	26073.50	38190.63	52197.11	68010.63	85575.16	114845.22
	125801.81	148409.53	172655.00	198525.00	225010.09	255105.88	285806.75	318111.88	352021.56	387953.19

D-12

OK. SEG #HECID8

```
STAGE   249.00   251.68   254.37   257.05   259.74   262.42   265.11   267.79   270.47   273.16
        275.84   278.53   281.21   283.89   286.58   289.26   291.95   294.63   297.32   300.00

FLOW      0.00    2518.29    8066.79   15998.30   26073.50   38190.63   52197.11   68010.63   85575.16   1C4845.22
        125801.81  148409.53  172655.00  198525.06  226010.69  255806.75  285806.75  318111.88  352021.56  3E7537.19
```

MAXIMUM STAGE IS   256.0

MAXIMUM STAGE IS   259.8

MAXIMUM STAGE IS   261.2

MAXIMUM STAGE IS   262.7

MAXIMUM STAGE IS   265.2

MAXIMUM STAGE IS   267.4

**********   ***** ***   *********   **********   **********   **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 4-5

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	5	1	0	0	0	0	1	0	0

ROUTING DATA

	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
QLOSS	0.000	0.00	1	1	0	0		0
0.0								

	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STQRA	ISPRAT
	1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	245.0	300.0	1800.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
```
  0.00  300.00  100.00  250.00  105.00  245.00  245.00  500.00  245.00  250.00
630.00  300.00  631.00  300.00  632.00  300.00
```

```
STORAGE    0.00    47.59    95.91   145.56   196.77   249.53   302.86   359.74   417.18   477.18
         536.73   598.84   662.52   727.75   794.53   862.88   932.79  1004.25  1077.27  1151.85

OUTFLOW    0.00   3606.99  11437.00  22459.17  36341.84  52869.69  71899.58  93329.88  117085.42  143105.47
       17135E.41  201798.41  234403.81  269154.88  306036.50  345038.31  386152.69  429374.75  474703.06  521237.00

STAGE    245.00   247.89   250.79   253.68   256.58   259.47   262.37   265.26   268.16   271.05
         273.95   276.84   279.74   282.63   285.53   288.42   291.32   294.21   297.10   300.00

FLOW       0.00   3606.99  11437.00  22459.17  36341.84  52869.69  71899.58  93329.88  117085.42  143105.47
```

D-13

```
171358.41   201798.41   234403.81   269154.88   306036.50   345038.31   386152.69   429374.75   474703.06   5:2137.00
```

MAXIMUM STAGE IS   251.2

MAXIMUM STAGE IS   254.4

MAXIMUM STAGE IS   255.8

MAXIMUM STAGE IS   257.1

MAXIMUM STAGE IS   259.4

MAXIMUM STAGE IS   261.4

**********   **********   **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 5-6
```
ISTAQ  ICOMP  IECON  ITAPE   JPLT   JPRT  INAPE  ISTAGE  IAUTO
  6      1      0      0       0      0     1      0       0
```

ROUTING DATA
```
           IRES  ISAME  IOPT   IPMP   TSK   STORA  ISPRAT
            1      1     0      0     0.000    0.     0
```

```
QLOSS   CLOSS   AVG
 0.0    0.000   0.00
```

```
         LAG   AMSKK    X
          0    0.000  0.000
```

```
NSTPS  NSTDL
  1      0
```

```
ELNVT  ELMAX   RLNTH    SEL
241.0  290.0   1700.  0.00220
```

NORMAL DEPTH CHANNEL ROUTING

```
QN(1)   QN(2)   QN(3)
0.1000  0.0450  0.1000
0.1000
```

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
```
  0.00  290.00  105.00  250.00  210.00  241.00  520.00  241.00  550.00  250.00
630.00  290.00  631.00  290.00  632.00
```

```
STORAGE      0.00     33.15     70.19    111.12    155.60    201.60    248.80    297.20    346.80    397.60
           449.61    502.81    557.21    612.82    669.62    727.63    786.83    847.24    908.84    971.65

OUTFLOW      0.00   2376.16   7676.43  15352.24  25352.05  37530.88  51635.02  67571.52  85272.34 114685.80
         125772.02 148499.81 172844.34 198786.31 226310.22 255404.22 286055.31 318268.63 352027.25 367332.38

STAGE      241.00    243.58    246.16    248.74    251.32    253.89    256.47    259.05    261.63    264.21
           266.79    269.37    271.95    274.53    277.10    279.68    282.26    284.84    287.42    29C.00

FLOW         0.00   2376.16   7676.43  15352.24  25352.05  37530.88  51635.02  67571.52  85272.34 114685.80
         125772.02 148499.81 172844.34 198786.31 226310.22 255404.22 286059.31 318268.63 352027.25 367332.38
```

MAXIMUM STAGE IS   247.9

OK, SEG MHEC3DB

MAXIMUM STAGE IS   251.5
MAXIMUM STAGE IS   252.9
MAXIMUM STAGE IS   254.2
MAXIMUM STAGE IS   256.6
MAXIMUM STAGE IS   258.7

**********   **********   **********   **********   **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 6-7

ISTAQ	ICOMP	ITAPE	IECON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
7	1	0	0	0	0	0	1	0	0

ROUTING DATA

CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.000	0.00	1	1	0	0	0

QLOSS
0.0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0630	0.0450	0.0600	238.0	280.0	1600.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 270.00 450.00 260.00 600.00 600.00 650.00 238.00 1040.00 238.00
1060.00 250.00 1590.00 280.00 1591.00 280.00

STORAGE	0.00	32.19	65.43	99.71	135.04	171.42	209.63	253.26	302.75	356.11
	419.33	489.36	570.64	663.17	766.94	880.86	998.86	1120.03	1244.37	1371.88

OUTFLOW	0.00	2281.53	7276.31	14371.25	23331.31	34022.98	46840.00	61933.98	79197.67	98792.81
	120827.22	145121.00	172766.13	203992.53	239079.06	279445.38	325005.63	374613.44	428212.94	485765.00

STAGE	238.00	240.21	242.42	244.63	246.84	249.05	251.26	253.47	255.68	257.89
	260.11	262.32	264.53	266.74	268.95	271.16	273.37	275.58	277.79	280.00

FLOW	0.00	2281.53	7276.31	14371.25	23331.31	34022.98	46840.80	61933.98	79197.67	98792.81
	120827.22	145121.00	172766.13	203992.53	239079.06	279445.38	325005.63	374613.44	428212.94	485765.00

MAXIMUM STAGE IS   244.2
MAXIMUM STAGE IS   247.4
MAXIMUM STAGE IS   248.6

OK. SEG #HEC10B

MAXIMUM STAGE IS   250.0
MAXIMUM STAGE IS   252.1
MAXIMUM STAGE IS   253.9

**********   **********   **********   **********   **********

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 7-8

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
	8	1	0	0	0	0	1	0	0

ROUTING DATA

	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
	0.000	0.00	1	1	0	0	.0

QLOSS		NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRA?
0.0		1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0600	0.0450	0.0600	235.0	270.0	1400.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV,ELEV--ETC

0.00	270.00	80.00	250.00	1100.00	235.00	1300.00	235.00	1800.00	250.00
2300.00	260.00	2550.00	270.00	2551.00	270.00				

	QN(1)	QN(2)								
STORAGE	0.00	17.37	45.78	85.25	135.78	197.35	265.97	353.65	448.37	555.26
	662.08	777.79	899.40	1026.89	1160.02	1296.76	1436.66	1579.72	1725.95	1875.34
OUTFLOW	0.00	1039.68	3907.02	8908.19	16409.30	26766.31	40315.55	57394.49	78305.31	104065.47
	135252.22	170525.06	210360.53	254845.94	307213.25	368515.75	434543.50	505271.69	580677.88	660743.63
STAGE	235.00	236.84	238.68	240.53	242.37	244.21	246.05	247.89	249.74	251.58
	253.42	255.26	257.11	258.95	260.79	262.63	264.47	266.32	266.16	270.00
FLOW	0.00	1039.68	3907.02	8908.19	16409.30	26766.31	40315.55	57394.49	78305.31	104065.47
	135252.22	170525.06	210360.53	254845.94	307213.25	368515.75	434543.50	505271.69	580677.88	660743.63

MAXIMUM STAGE IS   241.5
MAXIMUM STAGE IS   244.1
MAXIMUM STAGE IS   245.0
MAXIMUM STAGE IS   245.9
MAXIMUM STAGE IS   247.4

D-16

MAXIMUM STAGE IS 248.6

**********   **********   **********   **********   **********

PEAK FLOW AND STORAGE ((END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS					
				RATIO 1 0.20	RATIO 2 0.40	RATIO 3 0.50	RATIO 4 0.60	RATIO 5 0.80	RATIO 6 1.00
HYDROGRAPH AT	1	39.22 (101.58)	1	5922. (167.70)	11845. (335.40)	14806. (419.25)	17767. (503.10)	23689. (670.81)	29612. (838.51)
HYDROGRAPH AT	2	20.00 (51.80)	1	4634. (131.22)	9268. (262.45)	11585. (328.06)	13903. (393.67)	18537. (524.90)	23171. (656.12)
2 COMBINED	A	59.22 (153.38)	1	9678. (274.06)	19357. (548.12)	24196. (685.15)	29035. (822.18)	38713. (1096.24)	48392. (1370.29)
ROUTED TO	B	59.22 (153.38)	1	9664. (273.65)	19328. (547.30)	24160. (684.13)	28992. (820.95)	38656. (1094.60)	48315. (1368.25)
HYDROGRAPH AT	3	18.17 (47.06)	1	4022. (113.89)	8044. (227.77)	10055. (284.72)	12066. (341.66)	16088. (455.55)	20109. (569.43)
2 COMBINED	B	77.39 (200.44)	1	13099. (370.92)	26198. (741.85)	32748. (927.31)	39297. (1112.77)	52396. (1483.70)	65495. (1854.62)
ROUTED TO	OUTFLOW	77.39 (200.44)	1	13055. (369.69)	26210. (742.20)	32785. (928.36)	39351. (1114.30)	52640. (1490.59)	65687. (1860.04)
ROUTED TO	1	77.39 (200.44)	1	13053. (369.61)	26192. (741.67)	32815. (929.22)	39377. (1115.02)	52619. (1490.01)	65662. (1859.35)
ROUTED TO	2	77.39 (200.44)	1	13039. (369.22)	26167. (740.97)	32828. (929.58)	39397. (1115.60)	52602. (1489.53)	65647. (1858.91)
ROUTED TO	3	77.39 (200.44)	1	13011. (368.43)	26132. (739.98)	32835. (929.79)	39382. (1115.18)	52617. (1489.93)	65609. (1857.85)
ROUTED TO	4	77.39 (200.44)	1	13055. (369.11)	26185. (741.42)	32800. (928.79)	39391. (1115.42)	52640. (1490.59)	65605. (1857.73)
ROUTED TO	5	77.39 (200.44)	1	12989. (367.82)	26103. (739.15)	32841. (929.94)	39384. (1115.23)	52649. (1490.85)	65582. (1857.08)
ROUTED TO	6	77.39 (200.44)	1	12985. (367.69)	26219. (742.41)	32733. (926.88)	39341. (1114.02)	52700. (1492.30)	65604. (1857.70)
ROUTED TO	7	77.39	1	12997.	26252.	32705.	39277.	52703.	65612.

D-17

```
                    ( 200.44)      ( 367.41)( 743.36)( 926.11)( 1112.20)( 1492.38)( 1857.91)(

ROUTED TO    8    77.39     1    13018.    26237.    32668.    39275.    52627.    65622.
                    ( 200.44)      ( 368.63)( 742.96)( 925.06)( 1112.13)( 1490.23)( 1858.21)(
```

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOF OF DAM
ELEVATION	297.00	297.00	304.50
STORAGE	1488.	1488.	2447.
OUTFLOW	0.	0.	6116.

PLAN 1 ....

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	307.15	2.65	2855.	13055.	12.00	47.00	0.00
0.40	310.40	5.90	3402.	26210.	19.00	47.00	0.00
0.50	311.74	7.24	3643.	32785.	22.00	47.00	0.00
0.60	312.99	8.49	3874.	39351.	24.00	47.00	0.00
0.80	315.20	10.70	4303.	52640.	28.00	47.00	0.00
1.00	316.75	12.25	4619.	65687.	30.00	47.00	0.00

PLAN 1   STATION   1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13053.	270.5	47.00
0.40	26192.	277.2	47.00
0.50	32815.	280.0	47.00
0.60	39377.	282.4	47.00
0.80	52619.	286.8	47.00
1.00	65662.	290.6	47.00

PLAN 1   STATION   2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13039.	270.4	47.00
0.40	26167.	277.4	47.00
0.50	32828.	280.2	47.00
0.60	39397.	282.6	47.00
0.80	52602.	286.9	47.00
1.00	65647.	290.6	47.00

PLAN 1   STATION   3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13011.	258.6	47.00
0.40	26132.	262.3	47.00
0.50	32835.	264.0	47.00
0.60	39592.	265.4	47.00

| 0.80 | 52617. | 268.0 | 47.00 |
| 1.00 | 65609. | 270.4 | 47.00 |

PLAN 1   STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13035.	256.0	47.00
0.40	26183.	259.8	47.00
0.50	32800.	261.2	47.00
0.60	39391.	262.7	47.00
0.80	52640.	265.2	47.00
1.00	65605.	267.4	47.00

PLAN 1   STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	12989.	251.2	47.00
0.40	26103.	254.4	47.00
0.50	32841.	255.8	47.00
0.60	39384.	257.1	47.00
0.80	52649.	259.4	47.00
1.00	65582.	261.4	47.00

PLAN 1   STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	12985.	247.9	47.00
0.40	26218.	251.5	47.00
0.50	32733.	252.9	47.00
0.60	39341.	254.2	47.00
0.80	52700.	256.6	47.00
1.00	65604.	258.7	47.00

PLAN 1   STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	12975.	244.2	47.00
0.40	26252.	247.4	47.00
0.50	32705.	248.8	47.00
0.60	39277.	250.0	47.00
0.80	52703.	252.1	47.00
1.00	65612.	253.9	47.00

PLAN 1   STATION 8

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13018.	241.5	46.00

OK, SEG #HEC1D8

0.40	26237.	244.1	47.00
0.50	32668.	245.0	47.00
0.60	39275.	245.9	47.00
0.80	52627.	247.4	47.00
1.00	65622.	248.6	47.00

```
*****************************
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* DAM SAFETY VERSION    JULY 1978 *
*   LAST MODIFICATION  26 FEB 79  *
*****************************
```

Burt Dam Hydrology

The drainage area for Burt Dam is sub-divided into 3 smaller drainage areas as shown below.
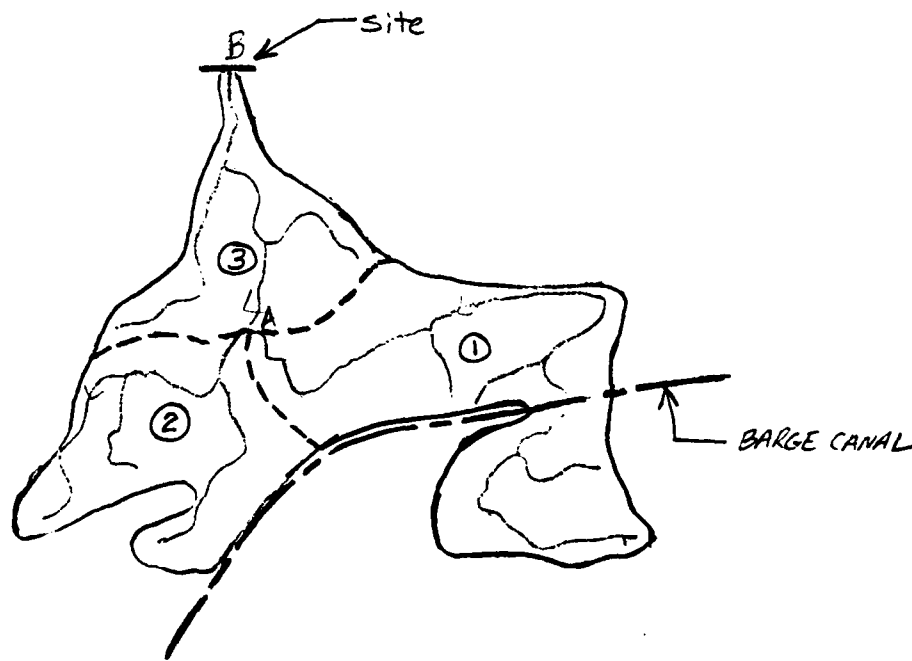
Summary Of Required Data

Sub-Area No.	Drainage Area (mi²)	L_c (ft.)	L_{ca} (ft.)	PMP Rainfall (Basin Avg.)	Reach Length(ft.)	Muskingum Coeff. K	Muskingum Coeff. X
1	25,102 AC = 39.22 mile²	125,400	39600'	21.8	—	—	—
2	12801 AC = 20 mile²	52,100	13,800	21.8	—	—	—
3	11,629 AC. = 18.17 mile²	36,800	24,000	21.8	36,000	.015	0.2

TOTAL = 77.39 mi²

D-21

BURT DAM NY 745
SUB-SECTIONS 1, 2 & 3

1. EFF. QUAD MAPS LOCKPORT, NEWFANE, CAMBRIA & GASPORT N.Y.
   SCALE 1" = 2000' CONTOUR INT. 10 FT.

2. REACH MEAS. WITH A MAP WHEEL 1" = 2000'
3. AREA MEAS. ON CROSS SECTION GRID 1" = 2000' & WITH PLANIMETER

SUB-AREA Nº 1

REACH LENGTH = 62.7 × 2000' = 125,400 ft. ✓

AREA IN ACRES = 25,101.92 AC. SEE CROSS SECT. SHEET Nº 1 FOR COMPUTATIONS ✓

SUB-AREA Nº 2

REACH LENGTH = 26.05 ✓ × 2000' = 52,100 ft. (EAST BRANCH EIGHTEEN MILE CREEK)

AREA IN ACRES = 12,801 ✓ SEE CROSS SECT. SHEET Nº 2 FOR COMPUTATIONS

SUB-AREA Nº 3

REACH LENGTH = 13.4 × 2000' = 26,800 ft. (EIGHTEEN MILE CREEK)

AREA IN ACRES = 11,620.0 AC. SEE CROSS SECTION SHEET Nº 2 COMPUTATIONS ✓

BURT DAM NY 745

L & Lca Distance MEAS. WITH A MAP MEAS. WHEEL SCALE 1" = 2000'

SUB. AREA № 1   REFF. QUAD MAPS NEWFANE & LOCKPORT, N.Y.

L DISTANCE = 62.7 × 2000' = 125,400 ft. ✓

LCA DISTANCE = 19.8 × 2000' = 39,600 ft. ✓

SUB. AREA № 2   REFF. QUAD MAPS LOCKPORT & CAMBRIA, NY

L DISTANCE = 26.05 × 2000' = 52,100 ft. ✓

LCA DISTANCE = 6.90 × 2000' = 13,800 ft. ✓

SUB. AREA № 3   REFF. QUAD MAPS LOCKPORT & GASPORT, N.Y.

L_c DISTANCE = 36,800

LCA DISTANCE = 12.0 × 2000 = 24,000 ft

SLOPE   CONTOUR El.   = 345

CONTOUR El. AT DAM = 260

El. h = 85'

REACH LENGTH = 18 × 2000 = 36000'

SLOPE = 85/36000 = 0.0024

D-23

DETERMINATION OF SNYDER'S LAG TIME

SUB - AREA NO. 1

$$\tau_p = C_\tau \left(L_c L_{ca} \right)^{0.3}$$

$$\tau_r = \frac{\tau_p}{5.5}$$

$$\tau_{PR} = \tau_p + 0.25 \left(\tau_R - \tau_r \right)$$

$C_\tau = 2.00$ ✓

$C_p = 0.63$ ✓

$$L_c = 125,400 \ ft ✓ = \frac{125400}{5280} = 23.75 \ \text{miles} ✓$$

$$L_{ca} = 39600 \ ft ✓ = \frac{39600}{5280} = 7.50 \ \text{miles} ✓$$

$$\tau_p = 2 \left(23.75 \times 7.50 \right)^{0.3} = 9.47 \ hrs ✓$$

$$\tau_r = \frac{9.47}{5.5} = 1.72 \ hrs. \longrightarrow \tau_R = 1 \ hr ✓$$

$$\tau_{PR} = 9.47 + 0.25 \left(1 - 1.72 \right) = 9.29 \ hrs. ✓$$

D-24

SUB-AREA NO. 2

$$L_e = 52100 \text{ ft} \checkmark = \frac{52100}{5280} = 9.87 \text{ MILES} \checkmark$$

$$L_{ea} = 13800 \text{ ft} \checkmark = \frac{13800}{5280} = 2.61 \text{ MILES} \checkmark$$

$$\tau_P = 2 (L_e \times L_{ea})^{0.3} = 5.30 \text{ hurs.} \checkmark$$

$$\tau_r = \frac{5.30}{5.5} = 0.96 \longrightarrow \tau_R = 1 \text{ hr.} \checkmark$$

$$\tau_{PR} = 5.30 + 0.25 (1 - 0.96) = 5.31 \text{ hrs} \checkmark$$

SUB-AREA NO. 3

$$L_e = 36800' \checkmark = \overset{6.97}{\cancel{7.0}} \text{ MILES} \checkmark$$

$$L_{ea} = 24000' \checkmark = 4.55 \text{ MILES} \checkmark$$

$$\tau_P = 2 (L_e \times L_{ea})^{0.3} = \overset{5.64}{\cancel{5.65}} \text{ hrs.}$$

$$\tau_r = \frac{\overset{5.64}{\cancel{5.65}}}{5.5} = 1.03 \text{ hrs} \checkmark \longrightarrow \tau_R = 1 \text{ hr} \checkmark$$

$$\tau_{PR} = 5.65 + 0.25 (1 - 1.03) = 5.64 \text{ hrs} \checkmark$$

DETERMINATION OF K FOR MUSKINGUM ROUTING

ASSUMPTIONS

$Q = 1.5$ cfs/ac.

$N = 0.06$

$R = y$ (HYDRAULIC RADIUS = CHANNEL DEPTH)

ASSUME RECTANGULAR CROSS SECTION OF LENGTH B

$$Q = \frac{1.49}{n} A R^{2/3} S_0^{1/2}$$

$$Q = \frac{1.49}{n} B y y^{2/3} S_0^{1/2} = \frac{1.49}{n} B Y^{5/3} S_0^{1/2}$$

solve eq. ① for y $y = \left[\dfrac{nQ}{1.49 \, S_0^{1/2} B} \right]^{3/5}$ ✓

$A = yB$

$V = \dfrac{Q}{A}$

$K = T = \dfrac{L}{V}$

$y = \left[\dfrac{nQ}{1.49 S_0^{1/2} B} \right]^{3/5}$

$n = 0.06$

$\Bigg\}$ $K = 0.146 L B^{\frac{2}{5}} Q^{-\frac{2}{5}} S_0^{-0.3}$ ✓

note: $K \cong$ Travel Time

D-26

ROUTING - MUSKINGUM METHOD

REACH A-B

$$K = 0.146 \, \ell \, B^{\frac{2}{5}} \, Q^{-\frac{2}{5}} \, S_0^{-0.3}$$

$$A = 25102 + 12801 = 37903 \text{ ac.}$$

ASSUME $Q = 1.5 \text{ cfs/ac}$

$$Q = 1.5 \times 37903 = 56854.5 \text{ cfs} \checkmark$$

$$\ell = 36000' \quad , \quad S_0 = 0.0024$$

ASSUME AN AVERAGE OF 650' FOR B

$$K = 0.146 \times 3600 \times 650^{0.4} \times 56854.5^{-0.4} \times 0.0024^{-0.3}$$

$$K = \underset{537}{\cancel{5368}} \text{ sec} = \underset{0.15 hrs}{\cancel{1.49}} \, hrs.$$

D-27

CHECK THE VALUE OF K

Assume $\Delta t = \dfrac{K}{I}$ $\qquad \Delta t = 0.15$ $\qquad X = 0.2$

$$\frac{\Delta t}{2(1-x)} \leq K \leq \frac{\Delta t}{2x} \qquad (\text{Ref } HEC-1)$$

$$\frac{0.15}{2(1-0.2)} \leq 0.15 \leq \frac{0.15}{2(0.2)}$$

$$0.094 \leq 0.15 \leq 0.375 \qquad \checkmark$$

BY _____ DATE _____
CKD _BR_ DATE _6/11/1991_ SUBJECT _____ SUB-SHEET NO. _1_
OWNER   PROJECT NAME _____

Emergency Spillway

Open channel flow, critical = 317.0 at bottom width

The equation $Q = 3.97 L H_0^{3/2}$ will be used to determine the flow over the emergency spillway.

Ref: Henderson, Open Channel Flow, pg. 181

$$Q = 3.97 L H^{3/2} = 3.97(75') H_0^{3/2}$$

$$Q = 297.75 H_i^{3/2}$$

El.	H_p	Q_s
297.0	0	0
298.0	1.0	298
	2.0	842
	3.0	1547
301.0	4.0	2382
	5.0	3329
	6.0	4376
304.0	7.0	5514
	7.5	6116
	8.0	6737
307.0	10.0	9416
	12.0	12377
311.0	14.0	15597
313.0	16.0	19056
315.0	18.0	22738
317.0	20.0	26632
	22.0	30725
320.0		32843

D-29

BURT DAM

A DALE1 RESEVOIR SURFACE AREA

REF. U.S. QUAD MAP NEWFANE NY SCALE 1'=2000'

Eq. $in^2 \times \frac{2000 ft^2}{in^2} \times \frac{1 AC}{43,560 ft^2}$

ELEV. 300

$\quad 1.4 \times 2000 ft^2 \div \frac{1 AC}{43560} = 128.56 \, AC$

ELEV 310

$\quad 1.9 \times 2000 ft^2 \div \frac{1 AC}{43560} = 174.47 \, AC$

ELEV. 320

$\quad 2.45 \times 2000 ft^2 \div \frac{1 AC}{43560} = 224.98 \, AC$

D-30

El. 320.0

El. 320.0

Crest of Dam

El. 304.50

El. 297.00

El. 304.50

18.6'

54.3'

15.0'

199.0'

43.4'

1.2
1.0

2.8
1.0

Burst Dam (looking ___ STREAM)

D-31

CORT DAM

*Length of section
should be long ...*

259.5 TOP DAM
7.5
302.0 SPILLCREST
42'
257.0 INV

10,200'
S = 0.0022

LAKE MEAN WS
245.0
10'±
235.0±
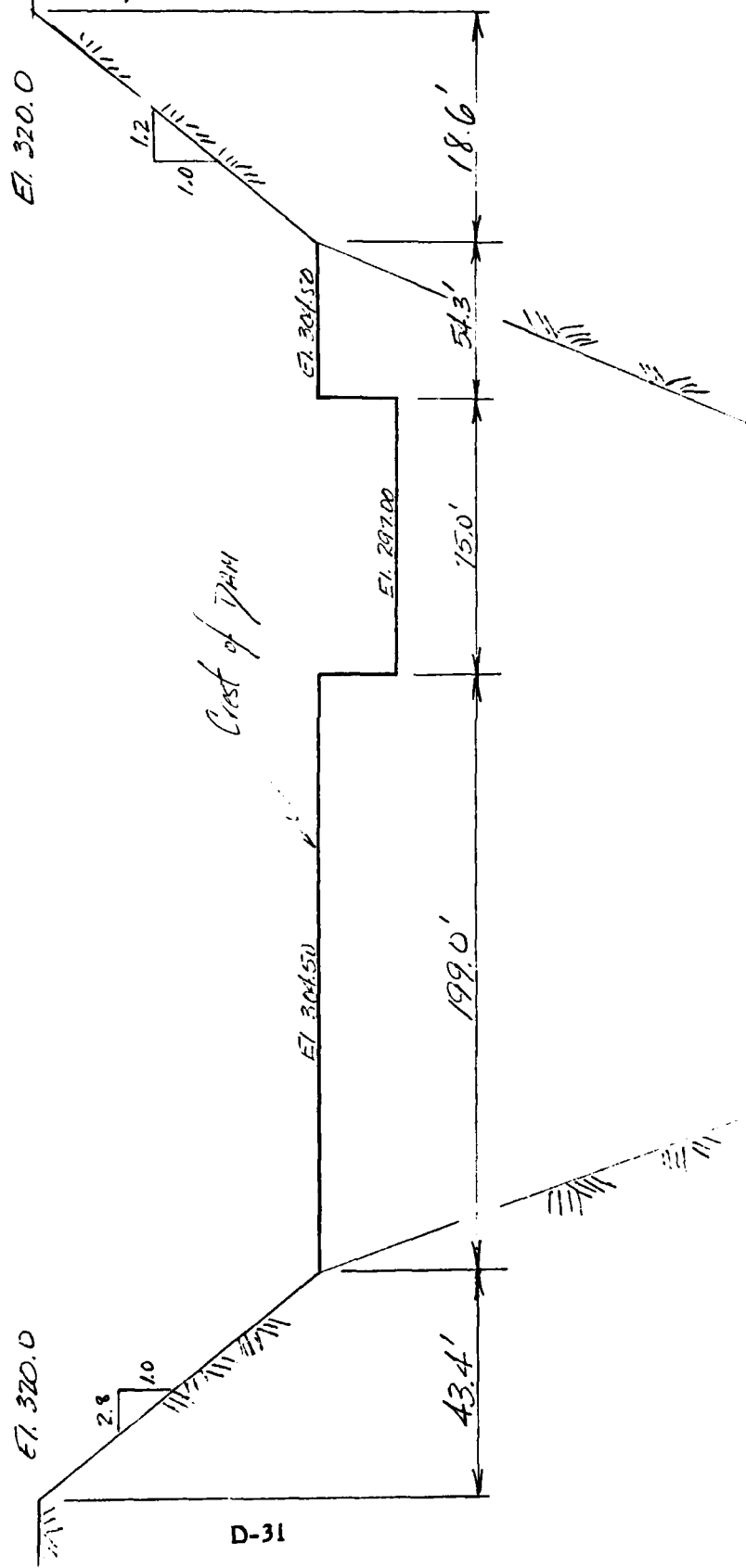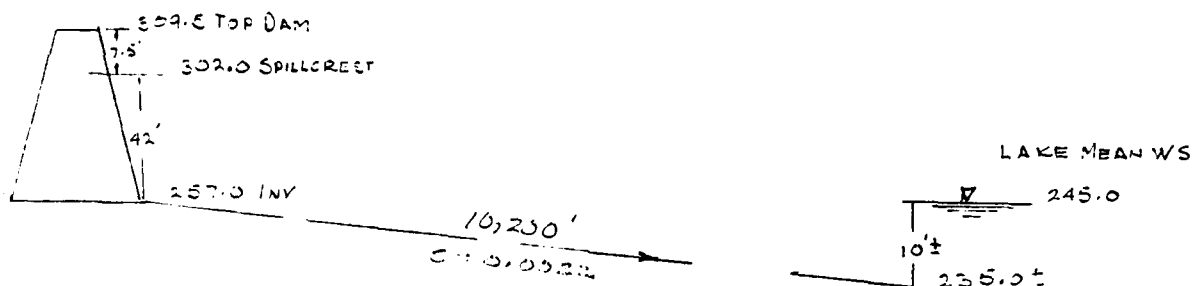
Eq. SLOPE = DAM INV − LAKE INV. = h ÷ L

$$S = 257.0 - 235.0 = 22' \div 10,200 = 0.0022$$

REACH 1 LENGTH = 500' ✓

SLOPE 500' × 0.0022 = 1.1 − 257. = 255.9 CREEK INV

CROSS SECT.	300	255.9	255.9	300
	0	80	270	330

REACH 2 LENGTH = 800' ✓

SLOPE = 800' × 0.0022 = 1.75 − 255.9 = 254.1 CREEK INV

CROSS SECT.	300	254.1	254.1	300
	0	110	240	400

REACH 3 LENGTH = 1300' ✓

SLOPE = 1300' × 0.0022 = 2.86 − 254.1 = 251.2 CREEK INV.

CROSS SECT	300	260	251.2	251.2	260.3	300
	0	150	210	430	515	565

REACH 4 LENGTH = 1100' ✓

SLOPE 1100' × 0.0022 = 2.42 − 251.2 = 248.8 CREEK INV.

CROSS SECT.	300	260	248.8	248.8	260	300
	0	120	190	500	570	600

D-32

REACH 5 LENGTH = 1300'

    SLOPE = 1300' × 0.0022 = 2.96 - 248.6 = 244.6 CREEK INV.

    Cross Sect = $\dfrac{300}{0}$ $\dfrac{250}{150}$ $\dfrac{244.8}{100}$ $\dfrac{244.8}{300}$ $\dfrac{250}{505}$ $\dfrac{300}{420}$

REACH 6 LENGTH = 1700'   ✓

    SLOPE = 1700' × 0.0022 = 3.79 - 244.8 = 241.0 CREEK INV.

    Cross Sect = $\dfrac{290}{0}$ $\dfrac{250}{100}$ $\dfrac{241.0}{210}$ $\dfrac{241.0}{520}$ $\dfrac{250}{550}$ $\dfrac{290}{630}$

REACH 7 LENGTH = 1600'   ✓

    SLOPE = 1600' × 0.0022 = 3.52 - 241.0 = 237.5

    Cross Sect. $\dfrac{270}{0}$ $\dfrac{260}{450}$ $\dfrac{250}{600}$ $\dfrac{237.5}{650}$ $\dfrac{237.5}{1040}$ $\dfrac{250}{1060}$ $\dfrac{280}{1590}$

REACH 8 LENGTH = 1400'

    SLOPE = 1300 × 0.0022 = 2.86 - 237.5 = 234.6   ✓

    Cross Sect. $\dfrac{270}{0}$ $\dfrac{250}{80}$ $\dfrac{234.6}{1100}$ $\dfrac{234.6}{1300}$ $\dfrac{250}{1800}$ $\dfrac{260}{2300}$ $\dfrac{270}{2550}$

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

(DAM NY 745)

AREA-CAPACITY DATA:

		Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1)	Top of Dam	304.5	149	2447
2)	Design High Water (Max. Design Pool)	302.0	131	2127
3)	Auxiliary Spillway Crest	N/A	—	—
4)	Pool Level with Flashboards	N/A	—	—
5)	Service Spillway Crest	297.0	95	1488

DISCHARGES

		Volume (cfs)
1)	Average Daily	unknown
2)	Spillway @ Maximum High Water	6116
3)	Spillway @ Design High Water	5953
4)	Spillway @ Auxiliary Spillway Crest Elevation	N/A
5)	Low Level Outlet (gated reservoir drain)	0
6)	Total (of all facilities) @ Maximum High Water	6116
7)	Maximum Known Flood (observed high water)	1867
8)	At Time of Inspection	250

CREST: ELEVATION: _304.5_

   Type: _Broad Crested Weir_

   Width: _____5 ft._____   Length _328 ft._

   Spillover _____

   Location _On Both Sides of the Spillway_

SPILLWAY:

SERVICE		AUXILIARY
297.0	Elevation	None
Concrete Ogee	Type	
75 ft.	Width	

                 Type of Control

✓	Uncontrolled	
	Controlled:	
	Type (Flashboards; gate)	
	Number	
	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
	Chute Length	
	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

HYDROMETEROLOGICAL GAGES:

Type : _____*None*_____

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: _____*None*_____

_____

Method of Controlled Releases (mechanisms):

_____*None*_____

_____

DRAINAGE AREA: _____ *77.4 sq. mi.* _____

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: *farmlands with orchards and woodlands*

Terrain - Relief: *flat, northward sloping*

Surface - Soil: *lake deposited sands and clays*

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

_____ *None* _____

_____

_____

Potential Sedimentation problem areas (natural or man-made; present or future)

_____ *None* _____

_____

_____

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

_____ *None* _____

_____

_____

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: _____ *None* _____

Elevation: _____

Reservoir:

Length @ Maximum Pool _____ *±0.25* _____ (Miles)

Length of Shoreline (@ Spillway Crest) _____ *±0.40* _____ (Miles)

80)

APPENDIX E

REFERENCES

APPENDIX E

REFERENCES

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4) T. W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1969.

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9) U.S. Department of the Army, Engineering Manual 1110-2-1411, Standard Project Flood Determinations, March 1952.

10) U.S. Army Corps of Engineers, The Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1) Users Manual for Dam Safety Investigations, September, 1978.
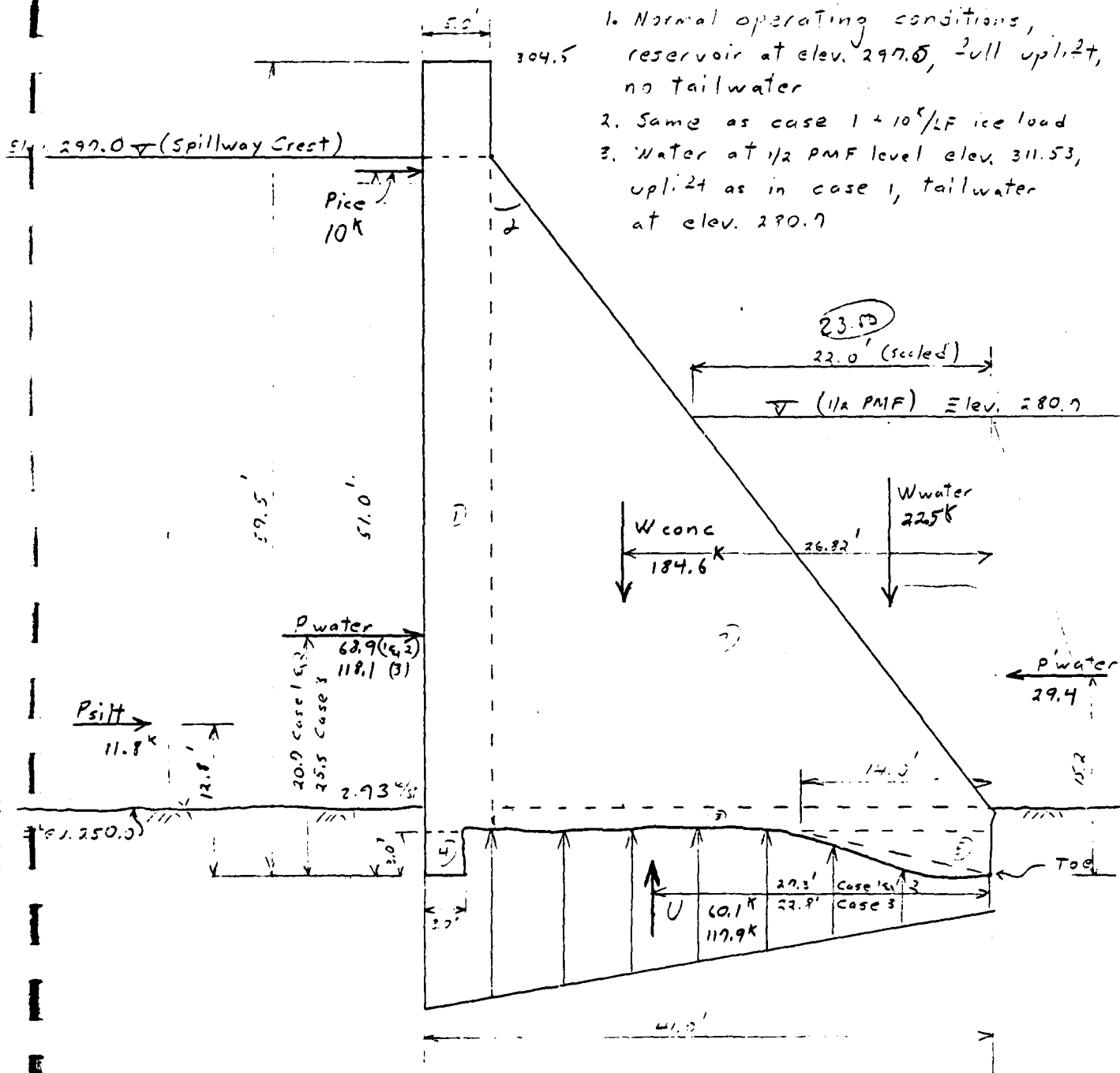
E-1

APPENDIX F

STABILITY ANALYSIS

Elev. 311.53 ▽ (½ PMF)

Loadings Considered:

1. Normal operating conditions, reservoir at elev. 297.0, full uplift, no tailwater
2. Same as case 1 + 10^k/LF ice load
3. Water at ½ PMF level elev. 311.53, uplift as in case 1, tailwater at elev. 280.7

304.5

Elev. 297.0 ▽ (Spillway Crest)

Pice 10^k

5.0'

(23.5) scaled 22.0' (scaled)

▽ (½ PMF) Elev. 280.7

59.5'   51.0'

Wconc 184.6^k 26.82'   Wwater 225^k

Pwater 68.9 (1,2) 118.1 (3)

P'water 29.4

Psilt 11.8^k

20.0 case 1 & 2   25.5 case 3

12.8'

2.73%

14.0'

Elev. 250.0   3.0'

U 60.1^k 117.9^k 22.3' Case 1 & 2   22.8' Case 3

Toe

41.0'

DAM SECTION

$$tg\alpha = \frac{36}{47} = 0.766$$

$$0.766 \times (280.7 - 250) = 23.50$$

F-2

END
DATE
FILMED
11 81

DTIC

Weight of Concrete - Wconc.

Dist from Toe

Area:					Dist from Toe		
①	$5.0' \times 56.5'$	=	282.5	×	$38.5'$	=	10876.25
②	$36.0' \times 47.0 \times \frac{1}{2}$	=	846.0	×	24.0	=	$20304.$
③	2.0×36.0	=	72.0	×	18.0	=	$1296.$
④	3.0×3.0	=	9.0	×	39.5	=	355.5
⑤	$3.0 \times 14.0 \times \frac{1}{2}$	=	$\underline{21.0}$	×	4.67	=	$\underline{98.07}$
			1230.5				32929.82

$$W_{conc} = 1230.5 ^{\#}/_1 \times .15 ^{K/\#} = \underline{184.6 ^K/_1}$$

$$Resultant \ (from \ Toe) = \frac{32929.82}{1230.5} = \underline{26.76'}$$

Water Force Pwater on Upstream Face

Case 1 & 2

$$P_{water} = \frac{(297.0 - 250.0)^2 \times .0624}{2} = \underline{68.9 ^K/_1}$$

Case 3

$$P_{water} = \frac{(311.53 - 250.0)^2 \times .0624}{2} = \underline{118.1 ^K/_1}$$

Water Force P'water on Downstream Face

Case 3

$$P'_{water} = \frac{(290.7 - 250.0)^2 \times .0624}{2} = \underline{29.4 ^K/_1}$$

Silt Force Psilt on Upstream Face

Assume depth of silt equals ½ depth of water.

PCA "Small Concrete Dams" p.9

$$P_{silt} = \frac{\left(\frac{297.0 - 250.0}{3}\right)^2 \times .085 \times 5}{2} = 11.8 - ^K/_1 \quad Assume \ k = .5$$

Weight of Water Wwater

$$W_w = (280.7 - 250.0) \times \underset{F-3}{\overset{23.5}{27.0}} \times \frac{1}{2} \times .0624 = 22.5 ^K$$

BY Farrell DATE 6-15-81 **ERDMAN, ANTHONY, ASSOCIATES** SHEET 3 OF 7

CK [initials] DATE 5/30/81 SUBJECT Stability Analysis SUB-SHEET NO.

OWNER PROJECT NAME Burt Dam — Phase I Inspection

Hydrostatic Uplift Force U

Case 1 & 2

$$U = (297.0 - 250.0) \times 41.0 \times \frac{1}{2} \times .0624 = 60.1 \, ^k/_1 \quad \checkmark$$

$$\text{Resultant (from toe)} = (41) \times \frac{2}{3} = 27.3' \quad \checkmark$$

Case 3

$$U = (280.7 - 250) \times 41.0 \times .0624 + (311.53 - 280.7) \times 41.0 \times \frac{1}{2} \times .062.$$
$$\overset{30.7}{} \qquad\qquad\qquad\qquad \overset{30.83}{}$$
$$= 78.5 + 39.4 = 117.9 \, ^k/_1 \quad \checkmark$$

$$\text{Resultant (from Toe)} = \frac{30.7 \times 41.0 \times \frac{41.0}{2} + 30.83 \times 41.0 \times \frac{1}{2} \times \frac{2}{3}}{30.7 \times 41.0 + 30.83 \times 41 \times \frac{1}{2}}$$

$$= 22.8' \quad \checkmark$$

Ice Force   Pice

$$Pice = 10 \, ^k/_1$$

$$\text{Resultant} = 51.0'$$

$$arms: \frac{47.0}{3} + 5.0 = 20.7'$$

$$\frac{2 \times 41}{3} = 27.3'$$

$$\frac{23.5}{3} + 5 = 12.8'$$

Stability Check

Case 1

$$\Sigma M \text{ overturning} = 60.1 \times 27.3' + 68.9 \times 20.7' + 11.8 \times 12.8 = 3218. \, ^{1K} \checkmark$$

$$\Sigma M \text{ resisting} = 184.6 \times 26.76 = 4940 \, ^{1K}$$

$$\Sigma F_V = 184.6 - 60.1 = 124.5^k \downarrow$$

$$\bar{x} = \frac{\Sigma M_R - \Sigma M_O}{\Sigma V} = \frac{4940 - 3218}{124.5} = 13.8' \qquad F.S._{OT} = \frac{4940}{3218} = \underline{1.54} \checkmark$$

$$e = \frac{B}{2} - \bar{x} = \frac{41}{2} - 13.8 = 6.7'$$

$$\frac{B}{6} = \frac{41}{6} = 6.8' > 6.7' \text{ ok}$$

$$\text{S.F. sliding} = \frac{.7 \times 124.5}{68.9 + 11.8} = \underline{1.08} \text{ N.G.}$$

conc. on rock, some laminations
PCA "Small Concrete Dams" p 12

$$\underline{\text{No Uplift}} = \frac{.7 \times 184.6}{68.9 + 11.8} = 1.60$$

F-4

BY _____ DATE 6-15-81   ERDMAN, ANTHONY, ASSOCIATES   SHEET 7 OF 7

CH _____ DATE _____ SUBJECT Stability Analysis   SUB-SHEET NO.

OWNER _____   PROJECT NAME Burt Dam - Phase I Inspection

Case 2 $\sum M_o = 60.1^k \times 27.3' + 68.9 \times 20.7 + 11.8 \times 12.9 + 100 \times 51.0 = 3728.^{'k}$

$\sum_R = 184.6 \times 26.82' = 4951^{'k}$ ✓

$\sum V = 184.6 - 60.1 = 124.5^k \downarrow$ $FS_{OT} = \dfrac{4951}{3728} = 1.33$

$\bar{x} = \dfrac{4951 - 3728}{124.5} = 9.82'$

$e = {}^B/_2 - \bar{x} = \dfrac{41}{2} - 9.82 = 10.68' > 6.8$ N G

$\text{F.S. sliding} = \dfrac{.7 \times 124.5}{68.9 + 11.8 + 10} = .96$

$\text{area:} \dfrac{61.53}{3} \rightarrow S = 20.5 + S - 2\cdots$

$30.7/_2 + S = 10.2 + S = 15.2$

Case 3 $\sum M_o = 117.9 \times 22.8 + 118.1 \times 25.5 + 11.8 \times 12.8 = 5850.7$ ✓

$\sum_R = 184.6 \times 26.82 + 22.5 \times \dfrac{23.5}{3} + 29.4 \times 15.2 = 5574.1$ ✓

$\sum V = 184.6 + 22.5 - 117.9 = 89.2^k$

$\bar{x} = \dfrac{5574.1 - 5850.7}{89.2} = -3.1$ $\text{F.S. } _{OT} = \dfrac{5574.1}{5850.7} = .95$

$e = {}^B/_2 - \bar{x} = \dfrac{41}{2} + 3.1 = 23.6 > 6.8$ N G

$\text{F.S. }_{sliding} = \dfrac{.7 \times 89.2}{118.1 + 11.8 - 29.4} = .62$

APPENDIX G

PREVIOUS INSPECTION REPORTS/
AVAILABLE DOCUMENTS

G-1

DAM INSPECTION REPORT
(By Visual Inspection)

am Number	River Basin	Town	County	Hazard Class	Date & Inspector
272	W LK ONTARIO	NEWFANE	NIAGARA	C	9/77 BC

Stream = EIGHTEEN MILE CREEK   Owner = NIAGARA MOHAWK - ?

Type of Construction

- ☐ Earth w/Concrete Spillway
- ☐ Earth w/Drop Inlet Pipe
- ☐ Earth w/Stone or Riprap Spillway
- ☒ Concrete
- ☐ Stone
- ☐ Timber
- ☐ Other _____

Use

- ☐ Water Supply
- ☐ Power
- ☐ Recreation - ☐ High Density
- ☐ Fish and Wildlife
- ☐ Farm Pond
- ☒ No Apparent Use-Abandoned
- ☐ Flood Control
- ☐ Other _____

Estimated Impoundment Size __95__ Acres ### Estimated Height of Dam above Streambed __45__ Ft.

Condition of Spillway

- ☒ Service satisfactory
- ☐ In need of repair or maintenance

- ☐ Auxiliary satisfactory
- ☐ In need of repair or maintenance

Explain: _Small Cracks in Concrete - No Leaks   1- 6'x6' Sluice gate to_ _drain impoundment_

Condition of Non-Overflow Section

- ☒ Satisfactory
- ☐ In need of repair or maintenance

Explain: _____

Condition of Mechanical Equipment

- ☐ Satisfactory
- ☐ In need of repair or maintenance

Explain: _Not Generating any power   2-penstocks 9'x14' blocked off._ _GENERATORS REMOVED_

Siltation   ☐ High   ☐ Low

Explain: _____

Remarks: _C · HAZARD - MARINA, HOUSES 2 MILES Downstream_

_____

_____

_____

Evaluation (From Visual Inspection)

- ☐ Repair req'd. beyond normal maint.
- ☒ No defects observed beyond normal maint.

G-2

Hon. Dwight B. La Du,
State Engineer,
Albany, N. Y.

Dear Sir:-

      Referring to the construction of the concrete power
dam on Eighteen Mile creek, at Burt, N. Y., I have twice
visited the site- once on August 13th, when a part of the
foundation was ready for inspection, and again on August 28th,
when the Contractors were ready to pour concrete.

      At the time of my first visit a portion of the east
end of the dam had been excavated and the trenches in the rock
for the foundation made. The rock on the surface is rather
soft red sandstone, which tends to disintegrate on exposure.
Lower down the rock is considerably higher and appears to be quite
free from seams. I suggested that a narrow trench be cut back
into the side of the rocky cliff so as to key the dam more se-
curely into the side. On my second visit a section about
40-feet long at the east end of the dam had been prepared for
concreting, and the key that I had suggested on my former visit
had been dug. The rock foundation was in very good shape to
receive the concrete.

      The Company is to notify me when another section
of the foundation will be ready and when I am so notified I
will inspect that.

          Very truly yours,
          Thos. J. Morrison,

          Thos. J. Morrison

          Division Engineer.

MCCARTHY BROS. & FORD,
ELECTRICAL HEADQUARTERS
SUPPLIES-ENGINEERING-CONTRACTING-REPAIRS

73-79 WEST MOHAWK ST.
BUFFALO, N.Y.

May 6 1924

Mr A R McKim
Dept of State Engineer & Surveyor
Albany   New York

Subject   Dam #272 W Ontario- Burt
Lockport & Newfane Water & Supply Co

Dear Sir:

With further reference to our telephone conversation today.
After talking with you, I received your letter and find that
the old print of Drawing 1330-E was sent you instead of the
revised print. I am accordingly attaching two prints of
revised Drawing 1330-E showing the revised section of the
Dam thru the power house.

Also am attaching two prints of drawing 1332-E showing revised
section of the spillway with steel re-inforcing as you suggest.

With reference to the application, advise that our pen stocks
will at all times be capable of accommodating a flow of not
less than 2141 CFS. As a matter of fact they will accommodate
a still greater flow of water.

On the basis of the application which you have and the revised
prints enclosed herewith, can you not let us have immediate
approval of this Dam and oblige

Very truly yours,

MCCARTHY BROS & FORD

Engineering Manager.

Karr Parker-B

Note: Blue prints being sent under separate cover.

G-4

McCarthy Bros. & Ford,

ELECTRICAL HEADQUARTERS

SUPPLIES-ENGINEERING-CONTRACTING-REPAIRS

75-79 WEST MOHAWK ST.
BUFFALO, N.Y.

April 25 1924

Arnold H Chapman, Deputy State Engineer
Telephone Building
Albany   N Y

Attention Mr A R McKim.
Subject   Lockport & Newfane Power & Water Supply Co.
Dam 272 W Ontario, Burt.

Gentlemen:

With further reference to the conference which I had with Mr McKim
on the 22nd instant regarding the application of the Lockport and
Newfane Power & Water Supply Co for the erection of a dam on
Eighteen Mile Creek at Burt N Y, I have revised the application and
plans in accordance with the agreement reached at this conference
and am forwarding herewith.

EXHIBIT A   Application for the construction of the dam.
This supercedes the previous application which was sent you.

EXHIBIT B   Three prints of revised drawing 1330-E showing
Power House plan and cross-section.

EXHIBIT C   Three prints of SK 1019 showing graphically the
forces in the dam, and three prints of Dwg 1332-E showing the dam.

You will note that we are providing for a maximum flow in accordance
with your letter of the 16th instant. We point out that this flow
is 12 times the normal flow of this stream and 5 times the greatest
known flood and we believe that the maximum runoff which is being
calculated is very much in excess of anything that it is necessary
to provide for. However, in view of the fact that we have met your
conditions, we would ask that you let us have your approval of the
revised plans at the earliest possible date.

Work is already under way at the site of the dam and I appreciate
very much Mr McKim's promise to give the revised application immediate
attention and wish to thank him for courtesies extended to me while in
Albany. In replying kindly address your communications to me and
oblige

Very truly yours,

Engineering Manager.

Karr Parker-B

G-5

Received _April 30 - 1924_ on Dam No. _272 W Ont_ Watershed

Disposition _Approved May 9-1924 & May 28_ of Serial No. _568_

Foundation inspected _____

Structure inspected _____

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended, for the approval of specifications and detailed drawings, marked _1330-E & 1332-E and Sheet #3 State Engineers Map of Eighteen Mile Creek 1919 Report Vol.1. site Western N Y Water Co._ herewith submitted for the { construction / reconstruction } of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about _October 1 1924_
(Date)

1. The dam will be on _Eighteen Mile Creek_ flowing into _Lake Ontario_ in the town of _Newfane_, County of _Niagara_ and _250 ft south of Highway Bridge at Burt N Y. 1.9 miles from Olcott Light House._
(Give exact distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream)

2. The name and address of the owner is _Lockport & Newfane Power & Water Supply Co, Middleport N.Y._

3. The dam will be used for _Generation of Electric Power._

4. Will any part of the dam be built upon or its pond flood any State lands? _No_

5. The watershed at the proposed dam draining into the pond to be formed thereby is _85_ square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of _95_ acres and will impound _173,000,000_ cubic feet of water.

7. The lowest part of the natural shore of the pond is _15_ feet vertically above the spillcrest, and everywhere else the shore will be at least _20- 42_ feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was _1000-1200_ cubic feet per second on _____ _Estimate no records. See State Engineers Report 1919 p.227-241._
(Date)

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam _No such possibility_
_____

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) _Limestone._

11. The material of the right bank, in the direction with the current, is __limestone__, at the spillcrest elevation this material has a top slope of __14.4__ inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of __several miles, see Map__ feet, and the top surface extends for a vertical height of __30__ feet above the spillcrest.

12. The material of the left bank is __limestone__, has a top slope of __34__ inches to a foot horizontal, a thickness of __several miles, see Map__ feet, and a height of __15__ feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. __Very hard and impervious__

14. If the bed is in layers, are the layers horizontal or inclined? __horizontal__ If inclined what is the direction of the horizontal outcropping relative to the axis of the main dam and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping

15. What is the thickness of the layers? __6-12 inches__

16. Are there any porous seams or fissures? __No__

17. WASTES. The spillway of the above proposed dam will be __75__ feet long in the clear; the waters will be held at the right end by a __Dam__ the top of which will be __7.5__ feet above the spillcrest, and have a top width of __5__ feet; and at the left end by a __dam, See Dwg 1330-E__ the top of which will be __7.5__ feet above the spillcrest, and have a top width of __5__ feet.

18. There will be also for flood discharge a pipe __inches inside diameter and the bottom will be__ feet below the spillcrest, a sluice or gate __6__ feet wide in the clear by __6__ feet high, and the bottom will be __45__ feet below the spillcrest.

19. APRON. Below the proposed dam there will be an apron built of __Concrete,__ __75__ feet long across the stream, __15__ feet wide and __9-4__ feet thick. The downstream side of the apron will have a thickness of __6__ feet for a width of __3__ feet. __See details on Dwg 1332-E.__

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings in triplicate of the proposed structure, one set of which will be returned if they are approved. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape.

the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the dam.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the application any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer. State the assumed ice and uplift pressures and the conditions on which based.

21. SKETCHES. For small and unimportant structures, if plans have not been made, on the back of this application make a sketch to scale for each different cross-section at the highest point; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillcrest; and outline the apron. Also sketch an elevation of each end of the dam with a cross section of the banks, giving the depth and width excavated into the banks.

22. ELEVATIONS. Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at the ends of the spill; of the spillcrest for the above proposed dam; and of the spillcrest of any adjacent dams.

23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand, one-half a cubic foot is desired (exclusive of any stone over ½ inch in size mixed therewith); for cement, three pints; and for the natural bed, twenty cubic inches if of ledge and one-half a cubic foot if of soil.

24. INSPECTION. State how inspection is to be provided for during construction. __Regular__ __inspection by a Professional Engineer licensed in the State of New York.__

25. WATER SUPPLY. Are the waters impounded by the above dam to be used for a public water supply? __No__ Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y.?

Maximum flow to be provided for according to State Engineer's letter 4-16-24 is
85 sq miles drainage on X64 CFS = 5440 FS
Maximum amount from Canal as per agreement
with the State of New York   500 CFS
                                        Total   5940 CFS

In respect to Item A we submit that this figure is very much in excess of
any floods which we have ever experienced on 18 Mile Creek, going back
20 years. Under chapter 425 Laws of 1918 the State Engineer made a
careful survey of this stream, see pp 227-241 of 1919 Report and calculated
that 307 acres of bottom land would be flooded if the flow was increased to
1000 CFS - as a matter of experience all this land has not been flooded as
far back as local records go.

The above flow will be provided for as follows (See Dwg 1332-E)

2 - Penststocks   9' x 14'   690 CFS
1 -   "   11' x 18'   551 CFS
1 - 6'x6' submerged sluice gate (h = 50')   1742 CFS

$Q = CA \sqrt{2gh} = 0.85 \times 36 \sqrt{64.4 \times 50}$

$Q = 1742$

Spillway 75' long x 5' max. depth of water   2970 CFS
                                        Total   5953 CFS

      Spillway Discharge Calculation

Francis' Formula $Q = 3.33 \ lh^{3/2}$

                  $l = 75'$, $h = 5'$

                  $Q = 3.33 \times 75 \times 5^{3/2} = 2970$ CFS

It will be noted that the normal elevation of water on the dam is 297 and
the maximum elevation under the above flood condition with 5 ft of water
on the spillway would be 302. It will be further noted that the water
cannot wash around the ends of the dam or overflow the banks and that no
damage would be done if the non-overflow section should be over-topped -
which latter condition we consider impossible as the maximum flow being
provided for is 12 times the normal flow of the stream and 5 times the
greatest known floods on this stream. Careful tests and records of other
hydro-electric plants on this stream show, for the past 8 years, that the
average flow is

            Canal water   375 CFS
            Natural run off   75- 125 CFS

            Total Flow   500 CFS

The above information is correct to the best of my knowledge and belief.

Middleport, New York
(Address of signer)

                              Lockport & Newfane Power & Water Supply Co

April 24 1924   F. S. Tracey   Manager
(Date)   (A person signing for owner should indicate his title or authority)

G-9

Lockport and Newfane Power and Water Supply Co.

OFFICE 16 STATE STREET

MIDDLEPORT. N. Y.   April 14th, 1924.

Mr. Arnold Chapman,
Ass't. State Eng.
Albany, N. Y.

Dear Sir:-

    I have your letter of recent date
covering the proposed dam #272 at Newfane
N. Y.

    Since receiving your letter, I have
noticed that we had the location as being 250 ft.
south of the highway bridge below Newfane, N. Y.
This location should have been 250 ft. south of
the highway bridge at Burt, N. Y., or about 11,000
ft. north of the highway bridge at Newfane, N. Y.
and approximately 1000 ft. south of the lake level
in this Creek.

    You also state that the maximum flow would
overflow the complete dam and spillway approximately
one foot. Kindly let me know the cubic flow you are
taking as a maximum flow. We have measured the
maximum flow that has been known as the maximum flow
for the past twenty years and found that it would
not exceed 1000 cu. ft. per second.

    If you will give me this information as soon
as possible, I will forward it to our engineer so that
we may have a new set of plans sent to you at once.

    Thanking you, we remain

        Yours very truly,

    LOCKPORT & NEWFANE POWER & WATER SUPPLY
                      CO.

    By   Mgr.

FST:AL

Received __March 25th 1924__ Dam No. __272 W One__ Watershed

Disposition __Not approved__ Serial No. __558__

Site inspected __Lake application approved__

Foundation inspected

Structure inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended, for the approval of specifications and detailed plans, marked __1330-E & 1332-E__

__Location Map Project N Y #15__

herewith submitted for the { construction / reconstruction } of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam.

1. The dam will be on __Eighteen Mile Creek__ branch of _____ in the town of __Newfane__, County of __Niagara__ and __250 ft north of highway bridge below Newfane N Y__

(Give exact distance and direction from a well-known bridge, dam, village, main cross-roads or mouth of a stream)

2. The name and address of the owner is __Lockport & Newfane Power & Water Supply Co Middleport N Y.__

3. The dam will be used for __Generation of Electric Power.__

4. Will any part of the dam be built upon or its pond flood any State lands? __No__

5. The watershed at the proposed dam draining into the pond to be formed thereby is __85__ square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of __95__ acres and will impound __173,000,000__ cubic feet of water.

7. The lowest part of the natural shore of the pond is __15__ feet vertically above the spillcrest, and everywhere else the shore will be at least __20-42__ feet above the spillcrest.

8. The maximum known flow of the stream at the dam site will __800-1000__ cubic feet per second on _____ (Date) __Estimate no records.__

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam __No such possibility__

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) __Limestone__

11. The material of the right bank, in the direction with the current, is __limestone__; at the spillcrest elevation this material has a top slope of __14.4__ inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of __7__ feet, and the top surface extends for a vertical height of __30__ feet above the spillcrest. __several miles, see Map__

12. The material of the left bank is __limestone__ has a top slope of __34__ inches to a foot horizontal, __several miles, see map__ a thickness of __/__ feet, and a height of __15__ feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. __Very hard and impervious__

14. If the bed is in layers, are the layers horizontal or inclined? __horizontal__ If inclined what is the direction of the slope relative to the center line of the dam and the inches vertical to a foot horizontal? _____

15. What is the thickness of the layers? __6-12 inches__

16. Are there any porous seams or fissures? __No__

17. WASTES. The spillway of the above proposed dam will be __45__ feet long in the clear; the waters will be held at the right end by a __Dam__ the top of which will be __4.5__ feet above the spillcrest, and have a top width of __5__ feet; and at the left end by a __Dam. See Dwg 1330-E__ the top of which will be __4.5__ feet above the spillcrest, and have a top width of __5__ feet.

18. There will be also for flood discharge a pipe _____ inches in diameter and the bottom will be _____ feet below the spillcrest, a sluice or gate __6__ feet wide in the clear by __6__ feet high, and the bottom will be __45__ feet below the spillcrest.

19. APRON. Below the proposed dam there will be an apron built of __concrete__, __45__ feet long, __15__ feet wide and __9-4__ feet thick. The downstream side of the apron will have a thickness of __6__ feet for a width of __2__ feet. __See Details on Dwg 1332-E.__

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings of the proposed structure. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape, the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the plans any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer.

21. SKETCHES. For small and unimportant structures, if plans have not been made, on the back sheet of this application make a sketch to scale for each different cross-section at the highest point; showing the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; and the abutments by their top width and top lengths from the upstream face of the spillcrest and give the elevation of the top in reference to the spillcrest.

22. ELEVATIONS. Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at both ends of the spill; and of the spillcrest for the above proposed dam.

23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand one-half a cubic foot is desired; for cement, three pints; and for the natural bed, twenty cubic inches.

Regular

24. INSPECTION. - State how inspection is to be provided for during construction_____
inspection by a Professional Engineer licensed in the State of New York.

25. WATER SUPPLY. Are the waters impounded by the above dam to be used for a public water supply? _____No_____. Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y. ?

I have carefully checked over the matter of the maximum flow of
water that can be expected in Eighteen Mile Creek and I am informed
by some of the plant officials in Lockport who have had experience
with this stream for many years, that 800 CFS has been considered
to be a very great flood and that only once in the past 15 years
did the flow ever reach 1000 CFS. This occasion was in the winter
time. Very careful surveys have been made by the State Engineer
showing the land which will be flooded if 1000 CFS is put down this
Creek. Our estimate of the maximum floods that ever have obtained
on this Creek is based on the known area of land which has been
flooded at these times.

The spillway as proposed is ample to take care of more than 1000 CFS
with all the turbine gates closed and in addition to that, there is
of course, the sluice gate which can also be used. It must be kept
in mind that practically all of the water coming down this Creek is
discharged from the Canal and that the stream is short, the drainage
there is small and it is relatively not subject to floods to anything
like the extent that a stream would be if its entire volume was
supplied from runoffs of a large drainage area.

See Column 1 page 227 of Report of New York State Engineer and
Surveyor (1919) on Survey of Eighteen Mile Creek - note maps
accompanying this report and showing site of proposed dam.

The above information is correct to the best of my knowledge and belief.

Middleport N.Y.
(Address of dam)

March 24-1924.
(Date)

The Lockport & Newfane Power and
Water Supply Company

by

E. Knapp, President

Roy L. Wheeler, Secretary
(A person signing the statement should indicate his title or authority.)

DATE ILME